Supplementary Materials for

Zoophycos macroevolution since 541 Ma

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Table S1

References

Table S1. Phanerozoic *Zoophycos* database

No. = Number of the item; **Basic morphology (3/S/H**), 3/S/H means the 3-D morphology (3), morphology in cross-section (S), and horizontal morphology (H), respectively. **W of MT (mm)** = Width of the marginal tube; **H of burrow (cm)**= Height of the burrow system, which is the distance between the top and bottom of the burrow system; **N of whorls** = Number of whorls; **Di of spreiten** = Dimension of spreiten, a×b×c = a cm in length, b cm in width and c cm in thickness, a and b are the maximum values of the whorls.; **Ref.** = references; **PD** in **Ref**. means Paleobiology Database (www.paleodb.org), **OC** in **REF**. means Our Collection. Empty box means the considering data was not found in the corresponding references.

No.	Era	Period	Epoch	Age	Locality	Longtitude/ latitude	Palaeo-latitude	Basic morphology(3/S/H)	W of MT (mm)	H of burrow (cm)	N of whorls	Di of spreiten（cm）	Host sediment	Environment	Ref.
1	Cenozoic	Quaternary	Holocene		Ontong Java Plateau, Micronesia	S 1 °37.5', E 159 °14.1'	-1.625	Cocks-tail shaped spreiten (H)		35			Calcareous nannofossil ooze	Bathyal zone	[1]
2					SONNE-114 Cruise Site 405	N 14 °40', E 119 °35'	14.67	Helicoidal *Spirophyton*-like spreiten (3)	2	13–27	14		Mud	Continental slope	[2]
3					SONNE-95 Cruise GIK17925-3	N 19 °51.2', E 119 °2.8'	19.85	Helicoidal *Spirophyton*-like spreiten (3)	2	33	37		Mud	Continental slope	[3]
4					LOMROG09-PC05, Lomonsov ridge	N 88.70 °, E 158.51 °	88.7	Helicoidal *Spirophyton*-like spreiten (3)		8	6		Mud	Continental slope	[4,5]
5					LOMROG09-PC10, Lomonsov ridge	N 89.45 °, W 130.38 °	89.45	Planar spreite (S)					Mud	Continental slope	[4,5]
6					AO96-14GC	N 89.45 °, W 130.38 °	87.01	Planar spreite (S)					Mud	Continental slope	[4,5]
7					M39029-4, M39029-8, Southern Iberian continental slope, Portugal	N 36 °02.5', W 8 °13.8'	36.042	Planar spreite (S)	2–3	30	4		homogeneously bioturbated unlithified sediments	Continental slope	[6-10]
8					70KL，Arabian sea, Indian Ocean	N 17 °30', E 61 °30'	17.5	Planar spreite (S)	5–15				mud	Bathyal zone	[11]
9					64KL，Arabian sea, Indian Ocean	N 19 °04', E 64 °41'	19.006	Planar spreite (S)	5–15				Mud	Bathyal zone	[11]
10					57KL，Arabian sea, Indian Ocean	N 20 °57', E 63 °07'	20.96	Planar spreite (S)	5–15				Mud	Bathyal zone	[11]
11					IMAGES core MD012388, Celebes Sea	N 6 °43', E 122 °56'	6.72	Planar spreite (S)					Nanofossil oozes and ash layers	Bathyal zone	[12]
12					SONNE 95 crusie, GIK17925-3, South China Sea	N 19 °51', E 119 °2.8'	19.83	Planar spreite (S)	4				Mud	Continental slope	[13]
13					METEOR cruis M39/1, core M39036, Atlantic	N 37 °48', W 9 °40.8'	37.8	Planar spreite (S)	4				Mud and clayey silts	Bathyal zone	[14]
14					METEOR cruis M39/1, core M39058, Atlantic	N 39 °2.4', W 10 °40.8'	39.006	Planar spreite (S)	4				Mud and clayey silts	Bathyal zone	[14]
15					METEOR cruis M39/1, core M39064, Atlantic	N 39 °59.2', W 9 °47.7'	39.99	Planar spreite (S)	4				Mud and clayey silts	Bathyal zone	[14]

16	Cenozoic	Quaternary	Holocene		Off NW Africa	N 13 °53', W 18°19'	13.88	Planar spreite (S)					Clay	Bathyal zone	[15]
17					Scotian slope, eastern Canada	N 42 °40', W 61 °40'	42.66	Planar spreite (S)	4				Turbidite and debris flow deposits	Continental slope	[16]
18			Pleistocene	Middle	Sonne 187-61, South China Sea	N 11 °25.5', E 111 °17'	11.425	Planar spreite (S)	4	20–28			Mudstone	Bathyal zone	[17]
19				Middle	Site 504, DSDP, Pacific	N 1 °20', W 83 °46'	1.33	Planar spreite (S)					Clay	Bathyal zone	[18]
20				Gelasian	Site 73, DSDP, Pacific	S 2 °14', W 138 °01'	-2.23	Planar spreite (S)	4				Mud	Continental slope	[19]
21					Off Valparaiso, Chile	S 33 °01', W 71 °41'	-33.001	Planar spreite (S)					Ooze	Continental slope	[20]
22		Neogene-Quaternary	Pliocene-Pleistocene		Site 301, 309, Atlantic	N 27 °01', W14 °20'	26.99	Planar spreite (S)	4	20–110				Continental slope	[21,22]
23					Site 310, 327,379, Atlantic	N 23 °22', W18 °01	23.39	Planar spreite (S)	4					Continental slope	[21]
24					Site 329, Atlantic	N 19 °01', W19 °59	19.05	Planar spreite (S)						Continental slope	[21]
25					Site 289,291, Atlantic	N 18 °01', W18 °02'	18.03	Planar spreite (S)						Continental slope	[21]
26					Site 205, 337, 347, Atlantic	N 16 °02', W18 °02'	16.05	Planar spreite (S)						Continental slope	[21]
27					Site 209, Atlantic	N 12 °51', W20 °16'	12.89	Planar spreite (S)						Continental slope	[21]
28					Site 239, Atlantic	N 14 °02', W18 °22'	14.05	Planar spreite (S)	4					Continental slope	[21]
29					Site 211, Atlantic	N 13 °50', W18 °24'	13.85	Tongue-like spreiten (3)	3	8	3			Continental slope	[21]
30					Site 219, Atlantic	N 12 °22', W17 °55'	12.39	Planar spreite (S)						Continental slope	[21]
31					GIK 16396, Iceland-Faeroe Ridge, Atlantic	N 61 °24', W 12 °13'	61.52	Planar spreite (S)	5				Clay	Continental slope	[23,24]
32				Piacenzian-Upper	Leg 178, site 1101, Pacific	S 64 °23', W 70 °16'	-64.37						Silty clay	Bathyal zone	[25]

33	Cenozoic	Neogene	Pliocene	Piacenzian	Site 504, DSDP, Pacific	N 1°20', W 83°46'	1.32	Planar spreite (S)					Clay	Bathyal zone	[18]
34				Piacenzian	Kolymbia, Rhodes, Greece	N 36°15', E 28°10'	36.25	Spiraling sheet-like lobate spreiten (3)	5	21	5	75×70×c	Limestone	Bathyal zone	[26]
35				Piacenzian	Leg 178, site 1096， Pacific	S 67°34', W 76°58'	-67.56						Silty clay	Bathyal zone	[25]
36				Piacenzian	DSDP 203core， Pacific	S 22°09', W 117°32'	-22.016	Planar spreite (S)	3		9		Nannofossil ooze	Bathyal zone	[27]
37				Piacenzian	Punta Corda, Ecuador	N 0°55'23", W79°46'33"	0.91		5	5	8		Siltstone–mudstone	shelf edge/uppermost slope	[28]
38				Piacenzian	Boso Peninsul, Japan	N 34°56', E 139°50'	34.92	Helicoidal *Spirophyton*-like spreiten (3)	5	22	13	51.69×55.84	Turbidite	Middle bathyal	[29-34]
39				Zanclean-Piacenzian	Sulu sea, Core 14210-5	N 9°50', E 119°48'	9.83	Planar spreite (S)		40			Mud and sand	Bathyal zone	[35]
40				Zanclean-Piacenzian	Sulu sea, Core 14224-1	N 7°40', E 121°30'	7.67	Planar spreite (S)					Mud and sand	Abyssal zone	[35]
41				Zanclean-Piacenzian	Sulu sea, Core 14233-5	N 8°52', E 121°52'	8.87	Planar spreite (S)					Mud and sand	Abyssal zone	[35]
42				Zanclean	ANDRILL 1B, Antarctic	S 77°46', E 171°28'	-77.76	Planar spreite (S)	2–4	2–6	4		Mud	Continental slope	[36]
43				Zanclean	Ecuador	N 1.0°, W 79.8°	0.8						Green, tuffaceous mudstone	Bathyal zone	[37], PD
44			Miocene	Messinian-Piacenzian	Leg 178, site 1095, Pacific	S 66°59', W 78°29'	-67.05						Silty clay	Bathyal zone	[25]
45				Messinian	North Taranaki coast, New Zealand	S 39°02', E 174°11'	-44.36	Spiraling sheet-like spreiten (3)		26	4	13.16×9.04	Mudstone and silty sandstone	Bathyal zone	[38]
46				Messinian	estern Raukumara Peninsula, New Zealand	S 38°50', E 178°30'	-38.82						Sandstone	Upper bathyal zone	[39]
47				Messinian	Leg 119, site 746, Indian Ocean	S 56°33', E 82°52'	-56.07						Clay, silt clay	Abyssal zone	[40]
48				Messinian	Rangamati-Chittagong Road section, Bangladesh	N22°34'05.59", E 91°56'13.31"	16.61						Mudstone	shelf	[41]
49				Messinian-Zanclean	Punta Perro, Chile	S 33°54'52.12", W 71°50'38.75"	-34.27	Planar spreite (S)					Sandstone	Continental slope	[42]

50	Cenozoic	Neogene	Miocene	Tortonian-Messinian	DSDP 223core, Indian Ocean	S 2 °48', E 87 °36'	-7.49	Planar spreite (S)	5				Nanofossil ooze	Bathyal zone	[27]
51				Tortonian-Messinian	Site 504, DSDP, Pacific	N 1 °20', W 83 °46'	0.41	Planar spreite (S)					Interbedded limestone, chalk, and chert	Bathyal zone	[18]
52				Tortonian-Messinian	Bardados ridge, leg 78, DSDP, Atlantic	N 15 °22', W59 °20'	15.23		4	8	7		Mud	Bathyal zone	[43]
53				Tortonian?	Site 178, DSDP, Pacific	N 56 °32', W 146 °30'	52.87	Planar spreite (S)	4				Mud	Bathyal zone	[19]
54				Tortonian	Coniale, Italy	N 44 °15', E 11 °46'	43.96	Planar spreite (S)	6			40×15	Mudstone	Bathyal zone	[44]
55				Tortonian	Punta Litre, Chile	S 37 °11.73', W73°33.64'	-37.58						Sandstone–mudstone	Bathyal zone	[45]
56				Serravallian-Tortonian	Monteleon Di puglia, faeto, Italy	N 41 °18', E 15 °09'	40.98	Spiraling lobate spreiten (3)	5			20×24×c	Limestone–marl	Bathyal zone	[46]
57				Langhian-Serravallian	Adana, Turkey	N 37 °00', E 35 °10'	36.72	*Rhizocorallium*-like spreiten (3)	4		6	10×7×c	Sandstone	Abyssal zone	[47]
58				Langhian-Serravallian	North Adana, Turkey	N 37 °06', E 35 °23'	36.72	U- or J-form spreiten (H)	5			1×5×c	Sandstone	Slope–Abyssal zone	[48]
59				Langhian-Serravallian	Carriacoa, Grenadines, Lesser Antilles	N 15 °10', W 62 °30'	15.13	Helicoidal spreiten (S)				a×13.7×c	Sandstone	Outer island shelf	[49]
60				Langhian	Baden, Vienna Basin, Austria	N 47 °59', E 16 °13'	47.64	Planar spreite (S)	4				Clay	Upper offshore	[50]
61				Langhian	Baden-Sooss, Austria	N47 °59.00', E 16°12.84'	47.65						Marl and shale	Bathyal zone	[51]
62				Langhian-Messinian	Monte dei Corvi, Conera Riviera, Ancona, Italy	N 43 °51', E 7 °50'	43.58		5–10	50			Limestone	Continental slope	[52]
63				Langhian	Grund, Austria	N 48 °38', E 16 °03'	48.95	J-form helicoidal lobate spreiten with long, *Rhizocorallium*-like lobes (3)	2–3	35	3-5	40×50×70	Sandstone	Upper offshore	[53,54]
64				Aquitanian	Cabo San Pablo beds, Fuegian Andes, Agentina	S 54 °30', W 66 °40'	-55.17	Helicoidal circular spreiten (3)					Mudstone	Continental slope	[55]
65				Aquitanian	Desdémona Formation, Fuegian Andes, Agentina	S 54 °30', W 66 °40'	-55.17	Helicoidal lobate spreiten (3)					Mudstone	Continental slope	[55]
66				Aquitanian	Leg28, site 269, Pacific	S 61 °41', E 140 °04'	-62.3						Clay, silt clay	Abyssal zone	[56,57]

67	Cenozoic	Neogene	Miocene	Aquitanian	DSDP 192core, Pacific	N 53 °60', E 164 °42'	48.48	Spiraling flat spreiten (H)					Limestone	Bathyal zone	[27]
68				Aquitanian-Messinina?	DSDP 223 core, Indian Ocean	S 2 °48', E 87 °36'	-3.31	Planar spreite (S)	4		6		Marly chalk	Bathyal zone	[58]
69				Aquitanian?	Caribbean cores 153, Caribbean sea	N 13 °40', W72 °27'	13.44	Planar spreite (S)	3				Clay	Bathyal zone	[59]
70				Aquitanian-Burdigalian	Leg 66 core, Pacific	N 14 °56', W94 °49'	15.52	Planar spreite (S)	4				Clay	Continental slope	[60]
71		Paleogene	Oligocene	Chattian	Leg28, site 267, Pacific	S 59 °16', E 104 °29'	-58.59						Nanofossil ooze, chalk	Abyssal zone	[56,57]
72				Chattian	Leg 113, site 693, Pacific	S 70 °50', W 114 °34'	-72.01						Nannofossil ooze, mudstone	Bathyal zone	[61]
73				Rupelian	Eastancia Mar á Cristina beds, Fuegian Andees, Agentina	S 54 °30', W 66 °40'	-56.12	Planar spreite (S)					Mudstone	Continental slope	[55]
74				Rupelian	DSDP 206core, Pacific	S 32 °00', E 165 °15'	-45.3	Planar spreite (S)	5				Nannofossil ooze	Bathyal–abyssal zone	[27]
75				Rupelian	Oldenburg,northwestern Deustchlands, German	N53 °12', E 8 °22'	52.74	Coiled spreiten (H)	4				Clay	Continental slope	[62]
76				Rupelian	Oldenburg,northwestern Deustchlands, German	N53 °12', E 8 °22'	52.74	Spiraling tongue-shaped spreiten (3)	4				Clay	Continental slope	[62]
77				Rupelian	Stern Creek, South Nelson, New Zealand	S 41 °17', E 173 °13'	-52.33	Helicoidal spiral spreiten (3)				66×64×c	Mudstone, marl and limestone	Continental slope	[63]
78				Rupelian	Motunau River, North Canterbury, New Zealand	S 42 °52', E 173 °00'	35.79	Helicoidal loabte spreiten	4			72×74×c	Limestone	Lower offshore	[64]
79				Rupetian	Hsuehshan Range, Taiwan	N24 °31.99', E121°23.77’	24.53	J-form spiraling spreiten (H)				48×40×c	Sandstone	Lower offshore	[65]
80				Rupelian	Zone IPM4 section Wujskie A, Poland	N49 °33.19', E 22°18.01’	49.44	Planar spreite (S)	2				Limestone	Bathyal zone	[66]
81				Rupelian-Chattian	Maritime ALPS, protula septaria, Italy	N 44 °15', E 7 °10'	38.42	U-form spiraling spreiten (H)	4			12×24×c	Siltstone and mudstone	Bathyal zone	[67]
82			Eocene	Priabonian-Messinian	Leg 113, site 689, Atlantic	S 64 °31', E 03 °06'	-63.31						Diatom-rich nannofossil ooze	Continental slope	[61]
83				Priabonian	DSDP 161core, Pacific	N 10 °14', W 139 °57'	2.54	Planar spreite (S)	4				Radiolarian ooze	Continental slope	[27]

84	Cenozoic	Paleogene	Eocene	Priabonian	Afales Bay, northern Ithaca, Ionian Isles, Greece	N 38°10', E 20°31'	32.79	Helicoidal lobate spreiten (3)	6	23	5	40×95×20		Bathyal zone	[68]
85				Priabonian	Afales Bay, northern Ithaca, Ionian Isles, Greece	N 38°10', E 20°31'	32.79	Helicoidal lobate spreiten (3)	5		2	60×63×C		Bathyal zone	[68]
86				Priabonian	Site 161A, DSDP, Pacific	N 11°49', W 139°12'	4.18	Planar spreite (S)	4					Bathyal zone	[19]
87				Priabonian	Site 41, DSDP, Pacific	N 20°01', W 140°22'	12.25	Planar spreite (S)					Nannofossil ooze	Bathyal zone	[69]
88				Priabonian	North Dalmatia, Croatia	N 43°34', E 16°48'	38.38	Coiled spreiten (H)				6×8×c	Sandstone	Offshore zone	[70]
89				Priabonian	Garulla-Amandola road, Italy	N 42°59', E 13°18'	38.02	J-form spiraling spreiten (3)	4			60 ×80×c	Siltstone	Bathyal–Abyssal zone	[71]
90				Bartonian	Camerino, Italy	N 43°08', E 13°04'	38.07	U-form spiraling spreiten (H)					Limestone	Continental slope	[72]
91				Bartonian-Priabonian?	Site 605, North American continental margin off New Jersey, USA	N 40°25', W 72°45'	39.83		5	9	19		Mudstone	Continental slope	[73]
92				Bartonian	Villapiana, Italy	N 29°50', E 16°27'	24.7	Spirally coiled spreiten (H)				5 ×7×c	Shale	Bathyal–Abyssal zone	[74]
93				Bartonian-Priabonian	Cerro Colorado Formation, Fuegian Andes, Agentian	S 54°30', W 66°40'	-56.79	U-form spiraling spreiten (H)					Mudstone	Continental slope	[75]
94				Bartonian-Langhian	Leg 113, set 696, Atlantic	S 61°51', W 42°56'	-61.72						Mudstone	Continental slope	[61]
95				Bartonian-Chattian	Leg 119, site 737, Pacific	S 50°14', E 104°29'	-50.2						Calcareous claystone	Continental slope	[40]
96				Bartonian	Villapiana, Itally	N39°51'41.03", E 16°29'30.02"	34.72	Helicoidal spreiten (H)	5			8×10×c	Carbonate and turbidites	Continental slope	[74]
97				Bartonian	Teherau Valley section, Buzau, Romania	N45°22'50.57", E26°27'57.44"	43.97	Helidoidal spreiten (H)				36 ×36 ×c	Sandstone	Bathyal zone	[76]
98				Lutetian	W of Jaca, southern Pyrenees, Spain	N 42°34', W 0°35'	40.72	U-form spiraling spreiten (3)	4			10×80×c	Sandstone	Bathyal zone	[77]
99				Lutetian-Bartonian	DSDP 161core, Pacific	N 10°14', W 139°57'	2.45	Planar spreite (S)	5				Radiolarian ooze	Continental slope	[27]
100				Lutetian	Slopnice, Poland	N 49°22', E 20°20'	38.47	U-form spiraling spreiten (3)	4	5		18×20×5	Siltstone	Continental slope	OC

101	Cenozoic	Paleogene	Eocene	Ypresian-Bartonian	Whaingaroan, Waipara district, North Caterbury, New Zealand	S 43°03', E 172°45'	-43.005	J-form spiraling spreiten (3)	5–7	2.5		26.5×12×c	Limestone	Lower offshore	78
102				Ypresian	Krościenko-Łakcica, Poland	N 49.46°, E 20.37°	40.69						Sandstone and mudstone	Bathyal zone	79
103				Ypresian?	Punta, Fuegian Andes, Agentina	S 54°30', W 66°40'	-56.97	Simple, circular spreiten (H)					Sandstone and mucstone	Bathyal zone	75
104				Ypresian	Agost section, Betic Cordillera, Spain	N 38°26'23.84", W 0°37'48.17"	34.13	U-shaped spiral spreiten	5			50×60×c	Marly limestone	Bathyal zone	80
105				Ypresian-Bartonian?	Carpathians, Bzova, Czechoslovak	N49°22', E 18°15'	43.66	J-shaped spiral spreiten (3)	4	8	5	20×34×c	Fine sandstone	Continental slope	81-84
106				Ypresian	Site 41, DSDP, Pacific	N 20°01', W 140°22'	10.53	Planar spreite (S)					Nanofossil ooze	Bathyal zone	69
107				Bartonian-Rupelian	Gönen Kale hill, Turkey	N 39°39.16', E 27°52.31'	39.69	Fan-shaped spreiten (H)				19×10×c	Calcarenite	Outer shelf	85
108				Ypresian-Lutetian	Reno Pass section, Illam, Zagros Basin, Iran	N 33°42.27', E 46°24.89'	20.83						Shale and wackestone	Bathyal zone	86
109				Ypresian-Lutetian	Hajbakhtiar section, Zagros Basin, Iran	N 33°48.07', E 46°8.29'	20.95						Shale and wackestone	Bathyal zone	86
110					Montanare section, Trasimeno area, Italy	N 43°4.36', E 12°14.85'	35.09	U-form spiraling spreiten (H)	6			a×30×c	Bioclastic mud	Bathyal zone	87
111				Ypresian?	Fuegian Andes, Argentina	S 54°30.76', W 66°18.1'	-56.99	Helicoidal spreiten (3)	5	5	4		Mudstone	Continental slope	88
112				Thanetian-Ypresian	Anhovo (H), Italy	N 46°04'16", E 13°36'22"	35.97	Tongue-like spreiten (H)	4			30×20×c	Limestone	Bathyal zone	89
113				Thanetian-Ypresian	Anhovo (H), Italy	N 46°04'16", E 13°36'22"	35.97	Plannar spreite (S)	4			75×75×c	Limestone	Bathyal zone	89
114				Thanetian-Ypresian	Pedrosa (M), Italy	N 46°09'50", E 13°29'52"	36.07	Planar spreite (S)	4		8	2×2×c	Limestone	Bathyal zone	89
115			Paleocene	Thanetian	Zumaya section, Itzurun beach, Spain	N 43°17'57", W 2°16'07"	37.43	Spiraling circular spreiten (H)				35×35×c	Muddy limestone	Bathyal zone	90-92
116				Thanetian	Zumaya section, Itzurun beach, Spain	N 43°17'57", W 2°16'07"	37.43	Tongue-like spreiten (H)	3–5			5×25×c	Muddy limestone	Bathyal zone	90-92
117				Thanetian	Zumaya section, Itzurun beach, Spain	N 43°17'57", W 2°16'07"	37.43	Flower-shaped spreiten (H)				6×8×c	Muddy limestone	Bathyal zone	90-92

118	Cenozoic	Paleogene	Paleocene	Thanetian	Zumaya section, Itzurun beach, Spain	N 43 °17'57", W 2 °16'07"	37.43	Spiral spreiten (H)				140 ×140 ×c	Muddy limestone	Bathyal zone	90-92
119				Thanetian	Zumaya section, Itzurun beach, Spain	N 43 °17'57", W 2 °16'07"	37.43	Conical shaped spreite (S)		30			Muddy limestone	Bathyal zone	90-92
120				Selandian	Sopelana section, Basque Basin, northern Spain	N 43 °23.26', W 2°59.691'	37.55	Spiraling lobate spreiten (H)	2–2.5				Grey marls	Bathyal zone	93
121				Danian	Busche village, Feltre, Italy	N 46 °00', E 11 °54'	41.11	Spiraling sheet-like spreiten (H)	5			40 ×60 ×c	Limestone	Bathyal zone	94-96
122				Danian	Ponte nelle Alpi, Italy	N 46 °08', E 12 °13'	41.1	Spiraling sheet-like spreiten (H)	5			20 ×100 ×c	Limestone	Bathyal zone	94,95
123				Danian	Rio de la vega, Tarifa, Spain	N 36 °00', W 5 °36'	31.81	U-form spiraling spreiten (H)	4		2	8 ×20 ×c	Calcareous turbidite	Bathyal zone	97
124				Danian	Cadiz, Spain	N 36 °31', W 6 °17'	32.34	Helicoidal conical spreiten (H)	4			7 ×12 ×c	Calcareous turbidite	Bathyal zone	97
125				Danian	Andalucia, Spain	N 36 °30', W 6 °16'	32.33	U-form spiraling spreiten (H)	5		4	10 ×15 ×c	Calcareous turbidite	Bathyal zone	97
126				Danian	Caravaca section, Spain	N 38 °03'47", W 1 °51'57"	32.18	U-form spiraling spreiten (H)	6			5 ×7 ×c	Marly limestone	Continental slope	98
127				Danian	Leg 74, Walris Ridge, DSDP, Atlantic	S 29 °30', E 3 °40'	-37.25	Planar spreite (S)	2–3				Chalk	Abyssal zone	99
128				Danian-Selandian	Carpathians, Val. Klobouky, Czechoslovak	N49 °09', E 18 °00'	43.44	J-form spiraling spreiten (H)	2–3			8 ×20 ×c	Marlstone	Continental slope	81-84
129				Danian-Selandian	Qpquqwe River and Te Kau Kau Point, south-estern, Wairarapa, New Zealand	S 41 °16', E 175 °19'	-54.47	Planar spreite (S)	5				Limestone	Bathyal zone	63
130				Danian	Kožbana, Goriška Brda, Slovenia	N 46 °02', E 13 °32'	35.9	Helicoidal spreiten (H)				60 ×60 ×c	Marl	Bathyal zone	100
131				Danian-Selandian	Pahoa River, Southeast Wellington, New Zealand	S 41 °20', E 174 °49'	-54.75	Planar spreite (S), helicoidal spreiten (3)	4			180 ×160 ×c	Limestone	Bathyal zone	101
132				Danian	Deva, Spain	N 43 °18', W 2 °14'	37.42						Limestone	Bathyal zone	102
133				Danian?	Passo delle, Capannele, L'Aquila, Italy	N42 °25', E 13 °33'	32.36	Helicoidal lobate spreiten (H)	4			10 ×15 ×c	Calcareous marls	Bathyal zone	103
134				Danian	Caravaca de la Cruz, Murcia Province, Spain	N 38 °06', W 1 °51'	32.12	Helicoidal lobate spreiten (3)	4–6	90	7	65 ×65 ×90	Marly limestone	Bathyal zone	104,105

135			**Paleocene**	Danian	Uzgrŭn, Moravia, Czech Republic	N 49 °28', E 18 °24'	39.36	U-form spiraling spreiten (H)	2–4			6 ×9 ×c	Sandstone	Bathyal zone	[106]
136	**Mesozoic**	**Cretaceous**	**Late**		Livorno, Italy	N 42 °32', E 0 °21'	30.96	Spiraling circular spreiten (3)	3				Limestone	Bathyal zone	[107]
137				Maastrichtian-Rupelian	North Canterbury and south Malbrough, New Zealand	S 43 °19', E 173 °12'	-55.06	Spiraling tongue-like spreiten (3)	4–5		15	100 ×90 ×c	Limestone	Bathyal zone	[108,109]
138				Maastrichtian-Ypressian	Site 41, DSDP, Pacific	N 20 °01', W 140 °22'	10.53	Planar spreite (S)						Bathyal zone	[69]
139				Masstrichtian-Danian	Bidart section, France	N 43 °26'31", W 1 °35'33"	37.53	Spiraling tongue-like spreiten (3)	4			40 ×40 ×c	Cretaceous marlstone and Paleogene marly limestone	Bathyal zone	[110,111]
140				Masstrichtian-Danian	Sopelana, Spain	N 43 °22'41", W 3 °00'59"	37.54	Planar spreite (S)	4				Cretaceous marlstone and Paleogene marly limestone	Bathyal zone	[111]
141				Masstrichtian	Neuberg, Austria	N 47.7 °, E 15.5 °	35.6						Sandstone and silty sandstone	Coastal	[112], PD
142				Masstrichtian	New Jersey coastal Plain, USA	N 40 °11', W 74 °15'	40.43	Planar spreite (S)	2–3				Sandstone	Offshore	[113]
143					Leg 119, site 738, Indian Ocean	S 62 °43', E 82 °47'	-65.38						Limestone chalk	Bathyal zone	[40]
144				Masstrichtian	Caribbean cores 146, Caribbean sea	N 14 °09', W69 °08'	13.54	Planar spreite (S)	3	8	14		Clay	Bathyal zone	[59]
145				Masstrichtian	Kulsti Rende, Stevens Klint, Denmark	N 55 °57', E 11 °35'	48.01	Planar spreite (S)	2–4				Flint	Bathyal zone	[114]
146				Masstrichtian	Englebel, limburg, Netherlands	N 51 °26', E 6 °04'	43.61	Helicoidal lobate spreiten (3)	2–4				Flint	Bathyal zone	[114]
147				Masstrichtian	Limhamn, Scania, Sweden	N 55 °34', E 12 °55'	47.58	U-form spiraling lobate spreiten (3)	2–4		7		Flint	Bathyal zone	[114]
148				Masstrichtian	Kjølby Gaar, NW Jylland, Denmark	N 56 °14', E 10 °36'	48.31	Planar spreite (S)	3–5		4		Flint	Bathyal zone	[58]
149				Masstrichtian	Dania Quarry, near Assens, Denmark	N 55 °16', E 9 °53'	47.34	Planar spreite (S)	2–3			8 ×20 ×c	Marl–chalk	Bathyal zone	[115]
150				Masstrichtian	Tüna, Tibet, China	N 27 °51', E 89 °04'	-24.34	Spiraling spreiten (H)	2–4			6 ×9 ×c	Limestone	Shelf margin	[116]
151				Masstrichtian	La Lajilla, Mexico	N 23 °40', W 98 °45'	29.82	U-form spiraling spreiten (H)	2–3			8 ×14 ×c	Sandstone	Lower offshore	[117]

152	Mesozoic	Cretaceous	Late	Masstrichtian	Northern and central New Jersey, USA	N 40 °41', W 74 °14'	40.92	Spiraling elliptical spreiten (3)	10	20		15 ×20 ×c	Muddy sand	Offshore	[113]
153				Masstrichtian	Bottaccione Gorge at Gubbio, Italy	N 43 °22', E 12 °35'	31.4						Limestone	Bathyal zone	[118]
154				Masstrichtian	Agos, Spain	N 38 °29', E 0 °36'	38.49	U-form spiraling spreiten (H)	3–5			4 ×14 ×c	Limestone	Bathyal zone	[119,120]
155				Masstrichtian	Leg 35, site 323, Pacific	S 63 °41', W 97 °60'	-60.81						Claystone	Abyssal zone	[121]
156				Maasstrichtian-Danian	Leg 74, Walris Ridge, DSDP, Atlantic	S 29 °30', E 3 °40'	-40.15	Planar spreite (S)	2–3				Chalk	Abyssal zone	[99]
157				Masstrichtian	Lameta Ghat section, Jabalpur area, India	N 23 °8'07", E 79 °51'07"	-33.688	Irregularly thin menisci (H)	3–4				Limestone	Lagoon	[122]
158				Masstrichtian	Kožbana, Goriška Brda, Slovenia	N 46 °02', E 13 °31'	27.79	J-form spiraling spreiten (H)	1–2			60 ×70 ×c	Marl	Bathyal zone	[100]
159				Masstrichtian	San Diego, California, USA	N 32 °40', W117 °14'	30.82	broad, flat, essentially circular spreiten (H)	5–6				Mudstone	Bathyal zone	[123]
160				Masstrichtian	Mead Hill, New Zealand	S 42 °20', E 173 °43'	-75.24						Chert	Bathyal zone	[124]
161				Maastrichtian	Vagge, Crocefieschi, Italy	N 44 °34.01', E 8°57.01’	33.17	J-form spiraling spreiten with lobes (H)				a ×17 ×c	Mixed siliciclastic–calcareous	Bathyal zone	[125]
162				Campanian	Leki quarry, Poland	N 49 °49.906', E 20°1.296’	41.79	Helicoidal lobate spreiten (H)		5		25 ×17.5 ×c	Sandstone	Bathyal zone	[126]
163				Campanian	Arras, cuifial, England	N 53 °52', W 0 °40	46.27						Chalk	Bathyal zone	[127]
164				Campanian	Warren farm, England	N 50 °48', W 1 °09'	43.26						Chalk	Bathyal zone	[127]
165				Campanian	St-Julien, France	N 48 °17', E 3 °51'	40.56						Chalk	Bathyal zone	[127]
166				Campanian	Arcis, France	N 48 °24', E 4 °13'	40.65						Chalk	Bathyal zone	[127]
167				Campanian	Leybach, Germany	N 47.4843 °, E 10.3053 °	32.97	U-form spiraling spreiten (H)	4–5		5	10 ×15 ×c	Marlstone	Bathyal zone	[128]
168				Campanian	Fachina Joch, Austria	N 47 °27`', E 9 °54'	33.02	Helicoidal spreiten (3)	4–5		5	10 ×14 ×c	Marlstone	Bathyal zone	[128]

169	Mesozoic	Cretaceous	Late	Campanian	Schmiedlaine Creek, Germany	N 47.6746 °, E11.4427 °	37.65	U-form spiraling spreiten (H)	4–5		4	11 ×13 ×c	Marlstone	Bathyal zone	[128]
170				Campanian	Western Alabama, USA	N 32 °19', W 86 °54'	35.7	Planar spreite (S)	5				Marl and limestone	Bathyal zone	[129,130]
171				Campanian	Spocari Quarry, western Alabama, USA	N 32 °16'18", W 87 °47'03"	35.86	Planar spreite (S)	4				Marl–chalk	Bathyal zone	[129,130]
172				Campanian	E1 chingue bluff, Chile	S 51 °10', W 72 °30'	-52.95	Planar spreite (S)	3–4				Sandstone	Bathyal zone	[131]
173				Santonian	Caribbean cores 153, Caribbean sea	N 13 °40', W72 °27'	8.07	Planar spreite (S)	2–3				Clay	Bathyal zone	[59]
174				Santonian	Bystrý potok section, Ostrava, Czeck	N 49 °34', E 18 °18'	39.472	Spiral spreiten (H)				4 ×6 ×c	Turbiditic sandstone and shale	Bathyal zone	[132]
175				Santonian to Early/Lower Campanian	Buen Suceso Bay, Argentina	S 54.8 °, W 65.3 °	-57.9						Sandstone	Offshore	[133], PD
176				Coniacian	Margate, England	N 51 °22', E 1 °26'	43.72						Chalk	Bathyal zone	[127]
177				Coniacian	Dieppe, France	N 49 °55', E 1 °05'	42.31						Chalk	Bathyal zone	[127]
178				Coniacian	Vitry, France	N 48 °27', E 4 °20'	40.68						Chalk	Bathyal zone	[127]
179				Coniacian	Butser Hill, England	N 51 °01'12.13", W 0 °58'49.18"	43.48						Flint	Bathyal zone	[134]
180				Coniacian	Beachy head, England	N 50 °44'14.83", E 0 °14'51.35"	43.15						Flint	Bathyal zone	[134]
181				Coniacian	western-central Kansas, USA	N 38 °38', W 100 °04'	43.55	U-form spiraling spreiten (H)	3–6			10 ×23 ×c	Chalky limestone	Lower offshore	[135]
182				Turonian-Coniacian, Santonian-Maastrichtian	Scotian shelf, Canada	N 43 °44', W 61 °09'	40.92						Limestone	Deep shelf zone	[136]
183				Turonian-Coniacian, Santonian-Maastrichtian	Grand banks, Canada	N 45 °01', W 50 °02'	39.88						Limestone	Deep shelf zone	[136]
184				Turonian-Campanian	Colorado, USA	N 40 °34', W 103 °56'	46.31	Planar spreite (S)	1–2				Limestone	Bathyal zone	[137]
185				Turonian-Campanian	Lyons Quarry section, Corolado,USA	N 39 °42', W 106 °21'	46.06	Planar spreite (S)	2–5	5			calcareous shale and marlstone	Bathyal zone	[137]

186	Mesozoic	Cretaceous	Late	Tuonian	Rzki, Poland	N 49 °49', E 19 °22'	41.77	U-form spiraling spreiten (3)	2–4	5	3	10×20×c	Marly limestone	Bathyal zone	OC
187				Tuonian	Black band, England	N 53 °36', W 0 °31'	46.03						Chalk	Bathyal zone	[127]
188				Tuonian	Sens bed well's columnar, France	N 48 °16', E 3 °56'	40.53						Chalk	Bathyal zone	[127]
189				Tuonian	Western Interior seaway of Alberta, Canada	N 52 °18', W 115 °47'	60.84						Mudstone	Shelf	[138]
190				Tuonian	Banos de la Hedionda, Betic Cordillera, Spain	N 36 °23'44", W 5 °15'42"	36.396	Planar spreite (S)	2–3	3			Marl limestone	Bathyal zone	[139-141]
191				Tuonian-Coniacian	Western Interior seaway of Alberta, Canada	N 52 °14', W 115 °20'	56.09	Planar spreite (S)	3–5				Sandstone	Upper offshore	[142]
192				Tuonian	Pembina Carrot Creet oilfield of west-central Alberta, Canda	N 52 °15', W 115 °37'	56,17	Vertical spiral spreiten (H)	8				Mudstone	Shelfal	[143]
193				Turonian	Western Interior Seaway, Canada	N 52 °46.4', W 116°50.18’	56.92						Siltstone and sandstone	Upper offshore	[138]
194				Turonian	Seebe, Albert, Canada	N 51 °05.04', W 115°3.74’	54.95	U-form spiraling spreiten (H)					Argillaceous siltstone	Upper offshore	[144]
195				Cenomanian	El Chorro, Penibetic, Spain	N 36 °54.87', W 4°45.92’	26.54	Planar spreite (S)	4				Marl limestone	Bathyal zone	[141]
196				Cenomanian-Turonian	Rybie section, Poland	N 49 °47.02', E 20°19.89’	40.23	Planar spreite (S)	2–3				Marlstone	Bathyal zone	[145]
197				Cenomanian	Sztolnia Section, Poland	N 49 °24.082', E 20°31.537’	33.27	Planar spreite (S)	1				Black shale	Bathyal zone	[146]
198				Cenomanian	Bottaccione section, Gubbio area, Italy	N 43 °21.701', E 12°34.309’	28.04	Planar spreite (S)	2–3				Black shale	Bathyal zone	[147]
199				Cenomanian	Contessa section, Gubbio area, Italy	N 43 °22.535', E 12 °33.646’	28.06	Planar spreite (S)	2–3				Black shale	Bathyal zone	[147]
200				Cenomanian-Zanclean	Leg 113, site 690, Atlantic	S 65 °09', E 01 °13'	-65.3						Nannofossil ooze	Bathyal zone	[61]
201				Cenomanian	Asham, Beachy head, England	N 50 °44', E 0 °17'	43.12						Chalk	Bathyal zone	[127]
202				Cenomanian	Antifer, France	N 49 °38', E 0 °10'	42.03						Chalk	Bathyal zone	[127]

203	Mesozoic	Cretaceous	Late	Cenomanian-Turonian	Devor, England	N 51 °07', E 1 °18'	41.29	Helicoidal sheet-like spreiten (3)	3–6	3		40 ×40 ×c	Chalk	Lower offshore	[148]
204				Cenomanian	Demoplis, Alabama, USA	N 32 °30', W 87 °50'	27.79	Planar spreite (S)	4–7	2		20 ×100 ×c	Marl and chalk	Bathyal zone	[149]
205				Cenomanian-Turonian	Northwestern James Ross island, Antactic	S 65 °10', W 58 °12'	-70.65	Planar spreite (S)	1.5				Mudstone	Bathyal zone	[150]
206				Albian, Santonian-Campanian, Maastrichtian	Fuegian Andes, Agentina	S 55 °14', W 67 °30'	46.12	Planar spreite (S)					Mudstone	Slope–volcaniclastic apron setting	[151]
207			Early	Albian	Le Brecce, 3km west of the town of Piobbico, Marche, Central Italy	N 43 °35'04", E 12 °29'12"	27.35	Planar spreite (S)	3–5				Shale	Bathyal zone	[152]
208				Albian	Calgary, Canada	N 51 °40', W 112 °09'	49.49	Planar spreite (S)	3–5				Muddy sandstone	Shelf	[153]
209				Aptian	Alexander island, Antarctica	S 70.8 °, E 68.5 °	-69.4						Sandstone and shale	Offshore	[154], PD
210				Aptian	Yuasa, Japan	N34 °02', E135 °10'	41.33	J-form spirally coiled spreiten (3)	3–4	3	2	6 ×8 ×3	Sandstone	Bathyal zone	[155]
211				Aptian-Coniacian	James Ross Island, Antarctic	S 64 °10', W 58 °20'	-67.42	Planar spreite (S)	2–3	3.5	3-7	8 ×7 ×c	Mudstone	Bathyal zone	[156]
212				Aptian-Cenomanian?	Vergons, France	N 43 °54', E 6 °35'	35.03		3–5			30 ×40 ×c	Marl–limestone alternation	Bathyal zone	[157-159]
213				Aptian-Cenomanian?	Angles, France	N 43 °56', E 6 °33'	35.04		3–5			30 ×40 ×c	Marl–limestone alternation	Bathyal zone	[157-159]
214				Aptian-Cenomanian?	Carajuan, France	N 43 °47', E 6 °26'	34.91		3–5			30 ×40 ×c	Marl–limestone alternation	Bathyal zone	[157-159]
215				Barremian	Pas de la Cluse, France	N 44 °27', E 5 °01'	34.33	Spiraling simple circular spreiten (H)	5			a ×60 ×c	Calcarenitic turbidite	Bathyal zone	[160]
216				Barremian	Pas de la Cluse, France	N 44 °27', E 5 °01'	34.33	Spiraling lobate spreiten (H)	20–30	3		a ×160 ×c	Calcarenitic turbidite	Bathyal zone	[160]
217				Barremian-Hauterivian	Alexander island, Antarctica	S 70.8 °, E 68.5 °	-65.6						Sandstone and shale	Offshore	[154], PD
218				Hauterivian	Vocontian Trough, La Charce, Marie, France	N 44 °31'12.48", E 5 °27'31.32"	34.49	J-form spiraling spreiten (H)	3–4	4	7		Marl–limestone alternation	Bathyal zone	[161]
219				Hauterivian-Valanginian	Alexander island, Antarctica	S 70.8 °, E 68.5 °	-63.3						Sandstone and shale	Offshore	[154], PD

220	Mesozoic	Cretaceous	Early	Hauterivian	La Charce, France	N 44 °28', E 5 °27'	35.56	Planar spreite (S)	3–5	1		30 ×60 ×c	Marl–limestone alternation	Bathyal zone	[157-159,162]
221				Valanginian	Perneck, Austria	N 47.7 °, E 13.7 °	32.8	J-form spiraling spreiten (H)				6 ×8 ×c	Sandstone	Bathyal zone	[163], PD
222				Valanginian	Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey wackestone	Bathyal zone	[164], PD
223				Valanginian	Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
224				Valanginian	Bed 3, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
225				Valanginian	Bed 9, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
226				Valanginian	Bed 11, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
227				Valanginian	Bed 13, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
228				Valanginian	Bed 15, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
229				Valanginian	Bed 17, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
230				Valanginian	Bed 19, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
231				Valanginian	Bed 25, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Gray, argillaceous limestone	Bathyal zone	[164], PD
232				Valanginian	Bed 27, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
233				Valanginian	Bed 29, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
234				Valanginian	Bed 31, Section KB1-A, Austria	N 47.9 °, E 14.4 °	32.6						Grey, argillaceous limestone	Bathyal zone	[164], PD
235				Valanginian	Dobresti, Southern Carpathians, Romania	N 45 °08'47.33", E 25 °07'28.66"	35.77	U-form spiraling spreiten (H) and planar spreite (S)	5		2	10 ×8 ×c	Limestone	Bathyal zone	[165,166]
236				Valanginian	Butkov quarry, Ladce, Slovakia	N 49 °2.67', E 18°31.69’	31.31	Planar spreite (S)	4				Bioturbated limestone	Bathyal zone	[167]

237	Mesozoic	Cretaceous	Early	Valanginian	Polomec quarry, Lietavsk á Lúčka, Slovakia	N 49 °72', E 18°71'	41.396	Planar spreite (S)	4				Bioturbated limestone	Bathyal zone	[167]
238				Valanginian-Albian	R ó Guanaco area, Agentina	S49 °57.18', W 72°4.93'	-48.95						Black shales and marls	Bathyal zone	[168]
239				Berriasian	Well 2287, Pervomaiskaya area, Russia	N 59 °27.53', E 75°05.8'	57.12	Planar spreite (S)	0.1–1				Mudstone	Bathyal zone	[169]
240				Berriasian	Tyumenskaya supperdeep well 6, Russia	N 66 °15.7', E 77°37.5'	63.93	Planar spreite (S)	0.1–1				Clayey–siliceous black shale	Bathyal zone	[169]
241				Berriasian	Well 2, Boltnaya area, Russia	N 58 °37.3', E 76°29.9'	56.52						Clayey–siliceous black shale	Bathyal zone	[169]
242				Berriasian	Castillon, France	N 43 °53', E 6 °30'	34.95	J-form spiraling spreiten (H)	3–5	8	3	30 ×60 ×c	Marl–limestone alternation	Bathyal zone	[157-159]
243				Berriasian	La Motte Chalacon, France	N 44 °28', E 5 °26'	35.56		3–5			30 ×40 ×c	Marl–limestone alternation	Bathyal zone	[157-159]
244				Berriasian?	Lioux, France	N 43 °53', E 6 °20'	35		3–5			30 ×40 ×c	Marl–limestone alternation	Bathyal zone	[157-159]
245				Berriasian?	Taloire, France	N 43 °49', E 6 °26'	34.93		3–5			30 ×40 ×c	Marl–limestone alternation	Bathyal zone	[157-159]
246		Jurassic	Late	Tithonian	Gucuo, Nielamu,Tibet, China	N 28.7827 °, E 86.3408 °	-43.6	U-form spiraling spreiten (H)	2–4			20 ×30 ×c	Calcareous siltstone or micrite	Lower offshore	[170]
247				Kimmeridgian	Wadi Laban, Saudi Arabia	N 23 °50', E 45 °08'	-1.87	U-form spiraling spreiten (3)	3–4	4	4	5 ×8 ×c	Limestone	Shelf	[171]
248				Oxfordian	Kamaguna section,Jhura Dome, North of Kachchh, India	N23 °22'41", E 69 °33'73"	-23.85	U-form spiraling lobate spreiten (H)	2–4	2.5		10 ×24 ×c	Limestone and marl	Upper offshore	[172]
249				Oxfordian	Pellecchia mounts, Italy	N 42 °04', E 12 °43'	30.11	J-form spiraling spreiten (H)	2–3			30 ×40 ×c	Marly limestone	Lower offshore	[71,173]
250				Callovian-Kimmeridgian	Qinghai, China	N 33.1 °, E 91.8 °	23.6						Siliciclastics	Coastal plain	[174], PD
251			Middle	Bathonian	Sea cliffs near santa mera, Spain	N 43 °31', W 5 °20'	43.51	Helicoidal conical spreiten (H)	2–3		3		Marly limestone	Open shelf	[97]
252				Bathonian	South-Eastern France	N 43 °53', E 6 °20'	35	J-form spiraling spreiten (H)	3–5	5	2	30 ×40 ×c	Marl–limestone alternation	Continental slope	[175]
253				Bathonian	Chasteuil, France	N 43 °50', E 6 °25'	34.78	J-form spiraling spreiten (H)	3–5	3	3	40 ×120 ×c	Marl–limestone alternation	Lower Shelf	[157-159,176,177]

254	Mesozoic	Jurassic	Middle	Bathonian?	Teillon, France	N 43 °50', E 6 °25'	34.78	J-form spiraling spreiten (H)	3–5	2	2	40 ×120 ×c	Limestone	Lower Shelf	157-159,176,177
255				Bathonian	Ravin du Bès section, Bas Auran area, Subalpine Basin, SE France	N 43 °57.63', E 6°18.92'	34.92						Limestone–marl alternation	Bathyal zone	178
256				Bathonian	Ravin d'Auran Section,Bas Auran area, Subalpine Basin, SE France	N 43 °57.35', E 6°18.93'	34.91						Limestone–marl alternation	Bathyal zone	178
257				Bajocian	Ravin du Bès section, France	N 43 °56.80', E 6°17.92'	34.90						Limestone	Bathyal zone	179
258				Bajocian	Piening Klippen belt, inner and outer Carpathians, Poland	N 50 °14', E 20 °01'	42.1	Planar spreite (S)	2–4	0.4	2	12 ×20 ×c	Limestone	Bathyal zone	180
259				Bajocian?	Cadières de Brandis, France	N 43 °50', E 6 °26'	34.78		3–5			40 ×120 ×c	Limestone	Lower Shelf	157-159,176,177
260				Bajocian?	Chabrières, France	N 44 °00', E 6 °41'	34.97		3–5			40 ×52 ×c	Limestone	Lower Shelf	157-159,176,177
261				Bajocian?	Pierlas, France	N 44 °01', E 7 °02'	34.99		3–5	3	2	40 ×53 ×c	Limestone	Lower Shelf	157-159,176,177
262				Bajocian-Bathonian	de la Praia da mareta, Algarve, Portugal	N 39 °29', W 8 ° 05'	33.23	J-form spiraling spreiten (H)	2–4	4	3		Limestone	Lower offshore	181
263				Bajocian-Bathonian	Jumara Dome, Kachchh Basin, India	N 22 °38'10", E 70 °50'22"	-21.78	J-form spiraling spreiten (H)	2–4		2	17 ×30 ×c	Sandstone	Ramp (upper offshore)	182
264				Bajocian-Bathonian	Jara Dome, Kachchh Basin, India	N 22 °41'20", E 70 °46'33"	-21.71	J-form spiraling spreiten (H)	3–5		2	10 ×26 ×c	Sandstone	Ramp (upper offshore)	182
265				Bajocian	Delisa, Vienna, Austria	N 48.216 °, E 16.374 °	32.94	Spirally coiled sprieten (H)					Limestone	Lower offshore	183
266				Bajocian	La Baume, Castellane, France	N 43 °53'28", E 6 °30'02"	32.77						Limestone–mal alternations	Platform slope	184
267				Bajocian	Khechem el kelb section, Tunisia	N 35 °08'49.75", E 9 °41'44.29"	24.17						Limestone–mal alternations	Bathyal zone	185
268				Bajocian	Chaabet el Attaris, Turnisia	N 35 °14'21.35", E 9 °42'21.09"	24.25						Limestone–mal alternations	Bathyal zone	185
269				Bajocian	Kef el Hassine, Turnisia	N 35 °16'05.36", E 9 °41'44.61"	24.28						Limestone–mal alternations	Bathyal zone	185

270	Mesozoic	Jurassic	Middle	Bajocian	C1, the Middle Atlas, Couches du Selloum, Morocco	N 33°02'31.48", W 5°21'22.69"	28.14						Limestone–mal alternations	Upper offshore	186
271				Bajocian	C2, the Middle Atlas, Couches du Selloum, Morocco	N 33°03'45.88", W 5°21'03.59"	28.146						Limestone–mal alternations	Upper offshore	186
272				Bajocian	C3, the Middle Atlas, Couches du Selloum, Morocco	N 33°04'12.07", W 5°20'37.09"	28.149						Limestone–mal alternations	Upper offshore	186
273				Bajocian	C4, the Middle Atlas, Couches du Selloum, Morocco	N 33°04'52.09", W 5°19'58.15"	28.155						Limestone–mal alternations	Upper offshore	186
274				Bajocian	C6, the Middle Atlas, Couches du Selloum, Morocco	N 33°06'35.14", W 5°16'15.59"	28.154						Limestone–mal alternations	Upper offshore	186
275				Bajocian	C7, the Middle Atlas, Couches du Selloum, Morocco	N 33°07'22.90", W 5°15'27.40"	28.16						Limestone–mal alternations	Upper offshore	186
276				Bajocian	C9, the Middle Atlas, Couches du Selloum, Morocco	N 33°08'02.15", W 5°14'20.31"	28.16						Limestone–mal alternations	Upper offshore	186
277				Bajocian	C11, the Middle Atlas, Couches du Selloum, Morocco	N 33°04'44.34", W 5°20'23.71"	28.155						Limestone–mal alternations	Upper offshore	186
278				Aalenian-Bajocian	Blumens tein, Swiss	N 46°43', E 7°30'	37.82	U-form spiraling spreiten (H)	2–3				Limestone	Upper offshore	187
279				Aalenian?	Soleilhas, France	N 43°51', E 6°38'	34.8		3–5			40×50×c	Limestone	Carbonate platform (shelf)	157-159,176
280				Aalenian-Bajocian	Chaudon, digne, France	N 44°02', E 6°18'	34.98		3–5	4	3	a×40×c	Limestone	Carbonate platform (shelf)	157-159,176
281				Toarcian-Aalenian	Porto de Mos, Portugal	N 39°36'02.10", W 8°48'54.10"	30.81						Marl-limestone alterations	Bathyal zone	188
282				Toarcian-Aalenian	Alvaiazere, Portugal	N 39°49'28.07", W 8°22'52.12"	30.84						Marl-limestone alterations	Bathyal zone	188
283				Toarcian-Aalenian	Rabacal, Portugal	N 40°01'59.33", W 8°27'45.94"	31.06						Marl-limestone alterations	Bathyal zone	188
284				Toarcian-Aalenian	Cantanhede, Portugal	N 40°20'40.76", W 8°35'35.62"	31.38						Marl-limestone alterations	Bathyal zone	188

285	Mesozoic	Jurassic	**Middle**	Aalenian	Western border of Iberia, lusitanian basin, Portugal	N 39 °22', W 9 °22'	30.76						Marl-limestone alterations	Upper offshore?	[188]
286			**Early**	Toarcian	Valdorbia section, Perugia, Italy	N 43 °26', E 12 °41'	30.06	Planar spreite (S)	2–4	3–4	3	10×35×c	Marly limestone	Lower offshore	[189]
287				Sinemurian-Pliensbachian	Kriza of the Tatra Mts, between Krakow and Vien, Slovakia	N 49 °08'04", E 19 °59'18"	29.04	Planar spreite (S)	2–5	2	3		Limestone	Bathyal zone	[190]
288				Sinemurian-Pliensbachian	Tatra Mts, Eastern ALPS, Swiss	N 46 °35', E 9 °27'	33.89	Planar spreite (S)	2–5	2	3		Marl and limestone	Bathyal zone	[190]
289				Hettagian	Trentino-Alto Adige, Italy	N 45.9 °, E 11.1 °	31.9						Mudstone and wackestone	Peritidal	[191], PD
290				Hettagian	Trentino-Alto Adige, Italy	N 45.9 °, E 11.0 °	31.9						Mudstone and wackestone	Peritidal	[192], PD
291				Hettagian	Trentino-Alto Adige, Italy	N 45.8 °, E 11.1 °	31.9						Wackestone	Peritidal	[193], PD
292				Hettagian	Lavini di Marco, Rovereto, Italy	N 45 °49', E 11 °03'	32.57	J-form spiraling circular spreiten (H)	2–5	1	3	8.6×14.4×c	Wackestone and mudstone	Tidal-flat	[194]
293		Triassic	**Late**	Rhaetian	Roaring Bay, South Otago, New Zealand	S 46 °26', E169 °48'	-74.41	J-form spiraling spreiten (H)	3–4	2	2	8×15×c	Sandstone	Shelf	[195]
294				Rhaetian	J. Wahrah, Oman	N 23 °13.24', E 56°54.44'	-3.07	Rooster-tail-like spreiten (H)				15×10×c	Sandstone	Bathyal zone	[196]
295				Norian	Mt charon on the Hanmer Range,North Canterbury, New Zealand	S 42 °29', E 172 °45'	-74.91	J-form spiraling spreiten (H)	2–3	0.7	2		Lime mudstone	Lower offshore	[197]
296				Carnian?	Qumalai-Xieduo, Qinghai, China	N 34.10 °, E 95.45 °	29.04	J-form spreiten (incomplete) (H)	1–3			8×14×c	Siltstone or fine sandstone	Bathyal zone	[198]
297				Carnian	Ga'a'ma, Nandamu region, Rangtang, Sichuan, China	N 32.3906 °, E 101.0934 °	36.22						Sandstone	Bathyal zone	[199]
298				Carnian	Maladun, Songpan, Sichuan, China	N 33.06 °, E 102.92 °	37						Siltstone	Bathyal zone	[200]
299			**Middle**	Ladinian	Monte San Giorgio, Switzerland	N 45 °54.51', E 8°57.97'	7.95						Limestone	Bathyal zone	[201]
300				Anisian-Ladinian, maybe Ladinian	Hotzdorf, Germany	N 50 °57', E 11 °17'	42.19	U-form spreiten (H)	4	6	2	28×34×c	Calcilutites	Carbonate rampe	[202]
301				Anisian-Ladinian, maybe Ladinian	Kara-Korum ranges, Xingjiang, China	N 35 °24'53", E 78 °58'59"	37.15	J-form spiraling circular spreiten (H)	2–3			10×35×c	Siltstone	Bathyal zone	[203]

302		Triassic	**Middle**	Anisian-Ladinian, maybe Ladinian	Gelmeroda, Germany	N 50 °56'42", E 11 °17'20"	17.44	Lobe like spreiten (H)	3–4	0.5	1	25×10×c	Micritic limestone	Carbonate ramp	[204]
303			**Early**	Olenekian?	Middle Buntsandstein, Ruhr region, Germany	N49 °35', E9 °01'	15.65	U-form spiraling spreiten (H)	3–5		3	20×16×c	Red sandstone	Nearshore	[205]
304	Paleozoic	Permian	**Lopingian**	Changhsingian	Dongpan, Guangxi, China	N 23 °33', E 107 °40'	-2.45	Planar spreite (S)	2–3	0.3	1	3×5×c	Siliceous rock	Continental slope	OC
305				Changhsingian	Shangsi, Sichuna, China	N 32 °20.158', E 105 °26.546'	2.71	Planar spreite (S)					Limestone	Lower offshore-slope	[206]
306				Changhsingian	Lilang, lingti, Gungri, Kidul, Muth and Po sections, India	N 32 °24', E 78 °32'	-20.96	Planar spreite (S)	3–5			a×50×c	Black shale	Shelf	[207]
307				Changhsingian	Persian Gulf, Iran	N 26 °15', E 52°14'	-28.75	Planar spreite (S)	4				Mudstone	Subtidal zone	[208,209]
308				Changhsingian	Salbard, Spitsbergen, Norway	N 78 °2.23', E 13 °42.83'	41.15						Cherty shale	Abyssal zone	[210]
309				Changhsingian	Dolomites region, Northern Italy	N 46 °15.13', E 11 °31.99'	3.28						Limestone	Subtidal zone	[211]
310				Wuchiapingian?	Brooks Range, Alaska, USA	N 69 °16', W 144°01'	47.19	Helicoildal spreiten (H)				30×20×c	Sandy siltstone	Inner shelf	[212]
311			**Guadalupian**	Capitantian-Wuchiapingian	Sverdrup Basin, Hvitland Peninsula, Canada	N 81 °05', W 88 °33'	41.14						black siliceous, siltstone, shale	mid- to outer-ramp	[213]
312				Capitanian	Iran	N 32.9 °, E 50.1 °	-22.8						Limestone	Shallow subtidal	[214], PD
313				Capitanian	Svalis Dome, Barents Sea, Norway	N 73 °20.55', E 23 °14.42'	37.98						Cherty mudstone	Abyssal zone	[215]
314				Capitanian	Black head, sydney basin, Australia	S 32 °04', W 152 °32'	-59.28	Planar spreite (S)	3–9	0.9	2		Greywacke	Nearshore	[216,217]
315				Wordian	Huaf-Haushi Uplift of Interior, Oman	N 21 °00', E 57 °40'	-34.89	J-form spiraling spreiten (H)	2–4	0.4	2		Limestone	Nearshore	[218]
316				Roadian	Laibin, China	N 23 °43', E 109 °13'	-1.36	Planar spreite (S)	2–4	0.4	2		Wackstone	Slope	[216,219-221]
317				Roadian	Heshan Matian, Guangxi, China	N 23 °48', E 108 °52'	-1.52	Planar spreite (S)	1–4	0.4	2		Limestone	Lower offshore	[222]
318				Roadian	Shangsi, Sichuna, China	N 32 °20.158', E 105 °26.545'	2.71	U-form spiraling spreiten (H)	4	4		4×9×c	Limestone	Upper offshore	[206]

319	Paleozoic	Permian	Guadalupian		Roadian	Sverdrup basin, Canada	N 79 °30', W 80 °02'	27.97	J-form spiraling spreiten (H)	3–5		2		Sandstone	Shoreface	223
320	Paleozoic	Permian	Guadalupian		Roadian	Laibin, China	N 23 °43', E 109 °13'	-8.59	Planar spreite (S)	2–4	4	3		Greywacke	Lower offshore	219
321	Paleozoic	Permian	Cisuralian		Kungurian	Qixingjie, Lianyuan, Hunan, China	N 27.9015 °, E111.8581 °	-4.84	Planar spreite (S)	2–4				Wackestone	Lower offshore	224
322	Paleozoic	Permian	Cisuralian		Artinskian	Ishabel Formation, western Alberta, Canada	N53 °54', W17 °21'	53.9	Swirled, low conical mounds of radiationg filaments					Silty andstone and sandy limestone	Offshore	225,226
323	Paleozoic	Permian	Cisuralian		Artinskian	Central Alborz, Iran	N 35 °48.5', E 51°8.6’	-19.68	J-form spiraling srpeiten (H)				10×12×c	Limestone with chert	Open marine（Shelf）	227
324	Paleozoic	Permian	Cisuralian		Asselian	Satpura, Gondwana basin, India	N 22 °28', E 78 °14'	-54.14	Planar spreite (S)	3–4	0.4	1	13×27×c	Fine sandstone and mudstone	Lower shoreface to inner shelf	228
325	Paleozoic	Permian	Cisuralian		Asselian	Xizhangzhuang, Jiaozuo, China	N 35 °14', E 112 °54'	17.62	Planar spreite (S)	2–3	3	3		Limestone	Shelf margin	229,230
326	Paleozoic	Permian	Cisuralian		Asselian	Ranifanj Basin, India	N 23 °45', E 86 °42'	-70.31	Flat spiral spreiten (H)	2–9	5	4	8×15×c	Silty mudstone	Shelf	231
327	Paleozoic	Carboniferous	Pennsylvanian	Late	Kasimovian	Utah, USA	N 40 °26'23.98", W 112 °06'21.21"	7.1	Planar spreite (S)	2–3		1	8×12×c	Sandstone	Bathyal zone	232
328	Paleozoic	Carboniferous	Pennsylvanian	Late	Kasimovian	Kansas Edmonds Core No.1A, USA	N 39 °01'15.48", W 98 °25'29.38"	-0.42	Planar spreite (S)	2–3				Grey shale	Offshore	233
329	Paleozoic	Carboniferous	Pennsylvanian	Late	Kasimovian-Gzhelian	Carnic Alps, Italy	N 46 °31', E 13 °02'	-10.54	Helicoidal spreiten (H)	3–7		3	30×40×c	Sandstone	Lower offshore	234
330	Paleozoic	Carboniferous	Pennsylvanian	Late	Kasimovian	Oquirrh Basin, Utah, USA	N 41 °16', W111 °59'	3.45	Helicoidal spreiten (H)	2–3		1	12×10×c	Sandstone	Bathyal zone	232
331	Paleozoic	Carboniferous	Pennsylvanian	Middle	Moscovian	Priokskii, Voskresensk -Ozery-Kolomna, Russia	N 55 °03'47.44", E 38 °51'11.91"	15.42						Mudstone, packstone–wackestone	Open subtidal	235
332	Paleozoic	Carboniferous	Pennsylvanian	Middle	Moscovian-Kasimovian	Utah, USA	N 40 °10'10.73", W 111 °32'34.47"	6.61	U-form spiraling spreiten (H)				8×13×c		Bathyal zone	232
333	Paleozoic	Carboniferous	Pennsylvanian	Middle	Moscovian	Cape Breton, Nova Scotia, Canada	N 46 °19', W 60 °17'	-8.93	J-form spiraling spreiten (H)	6–10		1	a×24.5×c	Sandstone	Tidal flat	236
334	Paleozoic	Carboniferous	Pennsylvanian	Middle	Moscovian	Ciyao, Jingyuan, China	N 36.80 °, E 104.95 °	22.16	J-form spiraling spreiten (H) and planar spreite (S)	2–3			10×10×c	Pelsparite	Middle nearshore	237

335	Paleozoic	Carboniferous	Pennsylvanian	Middle	Moscovian	Utah, USA	N 40°12'19.79", W 111°30'26.14"	2.419	U-form spiraling spreiten (H)	2–3		2	8×14×c		Bathyal zone	[232]
336				Early	Bashkirian	Jungar Basin, China	N 44°38', E 89°54'	40.55	Planar spreite (S)	2–3	0.3			Mudstone and sandstone	Bathyal zone	[238]
337					Bashkirian	Guadalupe Box, Gilman, USA	N 35°43', W 106°45'	0.77	U-form spiraling spreiten (H)	2–3		2	21×30×c	Calcareous siltstone	Shelf	[239]
338					Bashkirian	Northeastern Kentucky, USA	N 38°17', W 83°20'	-6.62						Sandstone	Nearshore	[240]
339					Bashkirian	Duku road, Jungar Basin, Xingjiang, China	N 43.77°, E 84.4°	30.8						Marlite	Bathyal zone	[241]
340					Bashkirian	Northern Tennesse, USA	N 36°27', W 86°05'	-12.45	U-form spiraling spreiten (H)	2–3	0.3	2	10×14×c	Sandstone	Upper offshore	[242]
341					Bashkirian	Within the Walker and Fayette Counties, Black warrior basin, Alabama, USA	N 33°53', W 87°29'	-9.23						Sandstone	Upper offshore	[243]
342			Mississippian	Late	Serpukhovian	Caldas de san Adrian, Leon, Spain	N 43°09', W 5°37'	-3.69	J-form sprialing spreiten (H)	2–3	0.3	2	3×6×c	Micritic limestone	Slope	[97]
343					Serpukhovian	Xikuangshan, Hunana, China	N 27.778°, E111.495°	-10.47						Wackstone	Lower offshore	[244]
344					Serpukhovian	Shuizutang, Lianxian, Guangdong, China	N 24.622°, E 112.37941°	-9.42	Planar spreite (S)	5				Marlite	Lower offshore	[245]
345					Serpukhovian	Malanbian Shuiku, Xinshao, Hunan, China	N 27°21', E 111°25'	-12.58		1–3	0.3	1	7×20×c	Bioclastic limestone	Offshore	[246]
346					Serpukhovian	Malanbian Shuiku, Xinshao, Hunan, China	N 27°21', E 111°25'	-13.02				1	8×15×c	Limestone	Tidal flat	[246]
347					Serpukhovian	Asturias, Spain	N 43°14', W 5°58'	-14.61	Helicoidal spreiten (H)	2–3		1	8×14×c	Sandstone	Nearshore	[97]
348				Middle	Visean	Gilf Kebir-Abu Ras area, Egypt	N 23°35', E26°23'	-38.29	U-form spiraling spreiten (H)	2–3		1	7×16×c	Silty shale	Upper offshore	[247]
349					Visean	Dushan Ercengpo, Guizhou, China	N 25°47', E 107°17'	-14.05	Planar spreite (S)	5–6	0.5			Limestone	Upper offshore	OC
350					Visean	Luochen, Guangxi, China	N 24°47', E 108°51'	-12.36		2–4		2	15×20×c	Dark limestone	Upper offshore	[248]

351	Paleozoic	Carboniferous	Mississippian	Middle	Visean	Huxian Chini, Guangdong, China	N 23°27', E 113°13'	-8.64		3–5	0.5	2	10×15×c	Silty shale	Littoral zone	[249]
352					Visean	Hejialong, Luguan, Xinhua, Hunan, China	N 27°45', E 111°11'	-14.73	J-form spiraling spreiten (H)			2	11×16×c	Limestone	Shoreface	[250]
353					Visean	Shuichangbaoxiang, Longli, Guizhou, China	N 26°25', E 106°56'	-14.72	Spiraling tongue-like spreiten (H)	2–3		2	10×15×c	Dark limestone	Lower offshore	[251]
354					Visean	Dayu, Guiling, Guangxi, China	N 25°13', E 110°21'	-11.75	Spiraling tongue–like spreiten (H)	2–3		2	12×20×c	Bioclastic limestone	Upper offshore	[252]
355					Visean	Heatherslade Bay, Horizon 11, Wales, UK	N 51.6°, W 4.0°	-10.7						Shelly, packstone and mudstone	Shallow subtidal	[214], PD
356					Visean	Heatherslade Bay, Horizon 13, Wales, UK	N 51.6°, W 4.0°	-10.7						Shelly, packstone and mudstone	Shallow subtidal	[214], PD
357					Visean	Heatherslade Bay, Horizon 17, Wales, UK	N 51.6°, W 4.0°	-10.7						Shelly, packstone and mudstone	Shallow subtidal	[214], PD
358					Visean	Ogmore by Sea, Horizon 31, Wales, UK	N 51.6°, W 3.0°	-10.7						Shelly, packstone and mudstone	Shallow subtidal	[214], PD
359					Visean	Ogmore by Sea, Horizon 32, Wales, UK	N 51.6°, W 3.0°	-10.7						Shelly, packstone and mudstone	Shallow subtidal	[214], PD
360					Visean	Ogmore by Sea, Horizon 34, Wales, UK	N 51.6°, W 3.0°	-10.7						Shelly, packstone and lime mudstone	Shallow subtidal	[214], PD
361					Visean	Ogmore by Sea, Horizon 35, Wales, UK	N 51.6°, W 3.0°	-10.7						Shelly, packstone and lime mudstone	Shallow subtidal	[214], PD
362					Visean	Ogmore by Sea, Horizon 37, Wales, UK	N 51.6°, W 3.0°	-10.7						Shelly, packstone and lime mudstone	Shallow subtidal	[214], PD
363					Visean	Ogmore by Sea, Horizon 42, Wales, UK	N 51.6°, W 3.0°	-10.7						Silty lime mudstone	Peritidal	[214], PD
364					Visean	Malý Rabštýn, Czech Republic	N 49°40', E 17°23'	-6.83	Irregular lobate spreiten (H)	1.5–2.5			a×15×c	Turbidite	Bathyal zone	[253]
365					Visean	Indiana, USA	N 39.5°, W 86.5°	-19						Sandstone and shale	Delta plain	PD
366					Visean	Xikuangshan, Hunana, China	N 27.778°, E111.495°	-12.85	Spiral spreiten (H)					Wackestone	Lower offshore	[244]
367					Visean	Hejialong, Luguan, Xinhua, Hunan, China	N 27°45', E 111°11'	-13.92						Limestone`	Upper offshore	[250]

368	Paleozoic	Carboniferous	Mississippian	Middle	Visean	Paprotnia, Poland	N 52°12.28', E 20°25.41'	-4.62		1–5	3.5		16×7×3.5	Mudstone	Lower offshore	[254]
369				Early	Tournaisian-Visean	Tournai, Belgium	N 50°30', E 3°16'	2.37	J-form spiraling spreiten (H)	2–3	5	3	45×90×c	Limestone	Carbonate ramp	[255]
370					Tournaisian	Zhongpaixiang, Longli, Guizhou, China	N 26°28', E 106°57'	-14.72	Spiral spreiten (H)	2–3		3	10×35×c	Siltstone	Shoreface	[251]
371					Tournaisian	Mingzhuxiang, Longli, Guizhou, China	N 26°28', E 106°59'	-14.72	Spiraling circular spreiten (H)	2–3		2	30×45×c	Siltstone	Littoral zone	[251]
372					Tournaisian	Yvoir, Tournai, Belgium	N 50°19', E 4°52'	-9.01	Spiral spreiten (H)	2–3		3	a×40×c	Carbonate	Carbonate ramp	[256]
373					Tournaisian	western Montana, Utah, USA	N 41°13', W 112°18'	-1.41	U-form spiraling spreiten (H)	3–8		3	a×28×c	Limestone	Offshore	[257]
374					Tournaisian	Ogmore by sea, Swansea, South Wales	N 51°28'31.29", W 3°42'22.39"	-9.021	Regular spiral spreiten (H)				a×15×c	Packstone	Lower offshore	[258]
375					Tournaisian	Three Cliffs Bay, South Wales	N 51°34'19.25", W 4°06'53.51"	-8.96	Arcute spiral spreiten (H)				a×8×c	Graded limestone	Lower offshore	[258]
376					Tournaisian	Indiana, USA	N 39.8°, W 86.7°	-20						Siltstone	Shelf	PD
377					Tournaisian	Shuizutang, Lianxian, Guangdong, China	N 24.622°, E 112.37941°	-1.4	Planar spreite (S)	2.6–4	0.4			Wackestone	Upper offshore	[245]
378					Tournaisian	Chile	S 24.5°, W 69.5°	-64.4						Sandstone and shale	Nearshore	PD
379		Devonian	Late		Famennian	Cuyahoga County, Ohio, USA	N 41.5°, W 81.7°	-30.7						Shale and siltstone	Offshore	PD
380					Famennian	Cuyahoga County, Ohio, USA	N 41.6°, W 81.6°	-30.6						Shale and siltstone	Offshore	PD
381					Famennian	Kufra Basin, Libya	N 22°23', E24°07'	-51.23	J-form irregular spiraling spreiten (H)	3		1	a×40×c	Sandstone	Tidal	[259]
382					Famennian	Zhongcun, Shanyang, Shanxi, China	N 33.469°, E 110.212°	-10.23						Siltstone	Bathyal zone	[260]
383					Frasnian-Famennian	Guodingshan, Hanyang, China	N 30°34', E 114°10'	-2.06	U-form spiraling spreiten (H)	2–3		1	7×15×c	Sandstone	Lower shoreface	OC
384					Frasnian-Famennian	New York, USA	N 40°38', W 73°58'	-37.74	U-form / arcute spiraling spreiten (H)	2–3		1	10×18×c	Sandstone	Upper offshore	[242,261]

385	Paleozoic	Devonian	Late	Frasnian	Zhongcun, Shanyang, Shanxi, China	N 33.469°, E 110.212°	-9.19						Siltstone or calcareous sandstone	Bathyal zone	[260]
386				Frasnian	Hougaoping, Guangyuan, Sichuan, China	N 32°20', E 105°26'	-7.03	Spiraling circular spreiten (H)	1–2	0.2	1	3×7×c	Muddy siltstone	Upper offshore	[262]
387				Frasnian	Aragon, Spain	N 41.0°, W 1.0°	-34.8						Shale and sandstone	Shelf	PD
388				Frasnian	Northern Illinois, Gas #1 MAK Core, 1141.ft, USA	N 41°04'42.12", W 90°16'26.04"	-40.116	Planar spreite (S)	2–3			2×6×c	Bioturbated mudstone	Upper shelf	[263]
389			Middle	Givetian	New York, USA	N 42.8°, W 76.7°	-35.2					20×15×c	Calcareous sandstone	Lower nearshore	[264]
390				Givetian	North Cherry-Valley village, New YorK, USA	N 42.82°, W 74.78°	035.47	U-form spiraling coiled spreiten (H)				12×20×c	Calcareous sandstone	Lower nearshore	[264]
391				Givetian	Cayuga County, New York, USA	N 42.9°, W 76.5°	-37.2						Shelly, grey lime mudstone	Shallow subtidal	PD
392				Givetian	Onodaga County, New York, USA	N 42.9°, W 76.0°	-37.2						Shelly, grey wackestone	Shallow subtidal	PD
393				Givetian	Madison County, New York, USA	N 42.9°, W 75.9°	-37.3						Shelly, grey limestone	shallow subtidal	PD
394				Givetian	Onodaga County, New York, USA	N 42.9°, W 76.2°	-37.3						Shelly, grey, calcareous shale	lower shoreface	PD
395				Givetian	Cayuga County, New York, USA	N 42.8°, W 76.7°	-37.3						Grey lime mudstone	shallow subtidal	PD
396				Givetian	Onodaga County, New York, USA	N 42.9°, W 76.0°	-37.2						Shelly, grey limestone	Deep subbtidal shelf	PD
397				Givetian	Madison County, New York, USA	N 42.9°, W 75.9°	-37.3						Shelly, grey limestone	Deep subbtidal shelf	PD
398				Givetian	Cayuga County, New York, USA	N 42.9°, W 76.5°	-37.2						Shelly, grey, calcareous shale	Lower shoreface	PD
399				Givetian	Onodaga County, New York, USA	N 42.9°, W 76.4°	-37.2						Shelly, grey, calcareous shale	Lower shoreface	PD
400				Givetian	Madison County, New York, USA	N 42.8°, W 75.2°	-37.5						Grey, calcareous sandstone	Shoreface	PD
401				Givetian	Genesse County, New York, USA	N 43.0°, W 78.1°	-36.9						Grey, silty shale	Deep subtidal ramp	PD

402	Paleozoic	Devonian	Middle	Givetian	Livingston County, New York, USA	N 42.8°, W 77.8°	-37						Grey, silty shale	Deep subtidal ramp	PD
403				Givetian	Ontario Ounty, New York, USA	N 42.8°, W 77.0°	-37.2						Grey, calcareous shale	Deep subtidal ramp	PD
404				Givetian	Erie County, New York, USA	N 42.7°, W 78.9°	-37						Grey mudstone	Deep subtidal shelf	PD
405				Givetian	Livingston County, New York, USA	N 42.8°, W 77.9°	-37						Grey mudstone	Deep subtidal shelf	PD
406				Givetian	Dahekou, Dushan, Guizhou, USA	N 25°50', E 107°31'	-1.18	Helicoidal arcute spreiten (H)	4–12		1	17×20×c	Siltstone	Littoral zone	[265]
407				Givetian	Catskill Mts, east-central New York, USA	N 41°59'50.45", W 74°19'53.36"	-43.19	Helicoidal lobate spreiten (H)		0.4	1	a×20×c	Fine sandstone and siltstone	Nearshore to offshore	[266]
408				Givetian	Witteberg and bokkeveld series, ladismith district, South Africa	S 31°19', E19°04'	-62.23	Flat spirally coiled spreiten (H)	2–3	0.3	1	15×20×c	Sandstone	Littoral zone	[267]
409				Givetian	Witteberg and bokkeveld series, ladismith district, South Africa	S 31°19', E19°04'	-62.23	J-form spiraling spreiten (H)	2–3	0.3	1	18×20×c	Silty sandstone	Littoral zone	[267]
410				Givetian	Witteberg and bokkeveld series, ladismith district, South Africa	S 31°19', E19°04'	-62.23	J-form spiraling spreiten (H)	2–3	0.3	1	7×9×c	Sandstone	Littoral zone	[267]
411				Givetian	Witteberg and bokkeveld series, ladismith district, South Africa	S 31°19', E19°04'	-62.23	Flat spirally coiled sprieten (H)	2–3	0.3	1	14×21×c	Sandstone	Littoral zone	[267]
412				Givetian	North of Tamworth, NSW, Australia	S 31°03', E 150°55'	-12.83	Planar spreite (H)	2–3				Siltstone	Restricted neritic of moderate depth	[268]
413				Givetian	Palencia, Spain	N 43.0°, W 0.9°	-39						Limestone and shale	Offshore	PD
414				Givetian	Parnaiba Basin, Brazil	S7°56.4', W 41°58.2'	-71.84	J-form spiraling spreiten (H)				11×10.5×c	Fine sandstone	Lower offshore	[269]
415				Eifelian	Wujia, Guanyang, Guangxi, China	N 25°29', E 111°05'	-1.73	J-form spiraling spireten (H)	1–3			15×20×c	Muddy siltstone	Shoreface	[270]
416				Eifelian	Tongtianshuiku, Linwu, Hunan, China	N 25°18', E 112°29'	-1.92	J-form spiraling spireten (H)	1–5		1	6×7×c	Siltstone	Shoreface	[271,272]
417				Eifelian	Luguan, Xinhua,Hunan, China	N 27°45', E 111°12'	-3.93	J-form spiraling spireten (H)			1	7×14×c	Siltstone	Shoreface	[271,272]

418	Paleozoic	Devonian	**Middle**	Eifelian	Banshan, ningyuan, China	N 25°24', E 111°52'	-1.15	Spirally coiled sprieten (H)	2–3	0.3	1	8×12×c	Siltstone	Lower shoreface	OC
419				Emsian to Eifelian	Palencia, Spain	N 43.0°, W 0.9°	-44.1						Limestone–marl alternation	Offshore	PD
420				Emsian	Guangxi, China	N 22.0°, E 108.0°	3.8						Yellow mudstone	Bathyal zone	PD
421				Emsian	Luofo, Guangxi, China	N 22.0°, E 108.0°	3.8						Black, gray green mudstone	Bathyal zone	PD
422				Emsian	Palencia, Spain	N 42.9°, W 4.5°	-44.2						Shale and sandstone	Subtidal	PD
423				Emsian	Bohemia point, Czechoslovak	N 50°06', E 15°45'	-34.11	Helicoidal spreiten (H)	2–3	0.6			Bioclastic limestone	Lower offshore	[273]
424				Emsian	Ganxi, Beichuan, Sichuan, China	N 31°54', E 104°41'	-3.9	Spiraling circular/elliptical spreiten (H)	1–2	0.2	1	10×25×c	Siltstone	Upper offshore	OC
425				Emsian	Ganxi, Beichuan, Sichuan, China	N 31°51', E 103°40'	-3.56	U-form spiraling spreiten (H)	2–3	0.3	1	12×14×c	Muddy siltstone	Lower shoreface	OC
426				Emsian	Ganxi, Beichuan, Sichuan, China	N 31°51', E 103°40'	-3.56	J-form spiraling spreiten (H)	2–3	0.3	1	6×9×c	Muddy siltstone	Lower shoreface	OC
427			**Early**	Emsian	Mountainville, Quaary Hill, New York, USA	N 41°24', W74°12'	-43.79	Flat spirally coiled spreiten (H)	3–4		1	15×30×c	Sandstone	Offshore-onshore cycle	[274]
428				Pragian	Long mountain, Eureka country, Nevada, USA	N 39°46', W 116°50'	-20.53						Limestone	Lower offshore	[275]
429				Pragian	Parana Basin, Brazil	S 24°48', W 51°24'	-76.24						Siltstone	Offshore	[276]
430				Pragian	Ponta crossa, Brazil	S 25°08', W 50°14'	-76.85						Siltstone and mudstone	Upper offshore	[277]
431				Pragian to Emsian	Palencia, Spain	N 43.0°, W 0.9°	-46.1						gray shale and micaceous, calcareous siltstone	Offshore	PD
432				Pragian	northwestern Texas, USA	N 31°34', W 102°27'	-41.28	Planar spreite (S)	5–6				Limestone	Offshore	[278]
433				Pragian	Anddes, Bolivia	S 17°12', W 67°50'	-64.05	Flat spirally coiled spreiten (H)	4–10		1	15×85×c	Sandstone	Offshore	[279]
434				Lochkovian	Liujing, Hengxian, Guangxi, China	N 22°53', E 108°52'	2.55	J-form spiraling spreiten (H)	1–2		1	7×10×c	Siltstone	Shoreface	[280]

435	Paleozoic			Lochkovian	Woodmont section, Maryland, USA	N 38°58', W 77°05'	-52.87						Chert	Upper offshore	[20]
436	Paleozoic	Silurian	Ludlow	Ludfordian	Sierra del gallo, province salta, Agentina	S23°09', W 66°16'	-54.33	J-form spiraling spreiten (H)	3–4		1	8×15×c	Sandstone and siltstone	Lower offshore	[281]
437	Paleozoic	Silurian	Ludlow	Gorstian-Ludfordian	Quebec, Canada	N 48.2°, W 65.0°	-28.4						Argillaceous sandstone	Lower shoreface	PD
438	Paleozoic	Silurian	Llandovery	Aeronian	Sierra de Zapla, NW Agentina	S 38°51.18', W 69°48.63'	-42.84	J-form spiraling spreiten (H)				20×30×C	Siltstone	Muddy shelf (Lower offshore)	[282,283]
439	Paleozoic	Ordovician	Late	Hirnantian	Arrow Canyon Range, South Nevada, USA	N 36°30', W 114°51'	-17.25	J-form spiraling spreiten (H)	1–3		1	5×16×c	Quartzite	Upper offshore	[284]
440	Paleozoic	Ordovician	Late	Sandbian	Seal Creek, Australia	S 37°39', E 149°41'	14.44	Planar spreite (S)	5–7				Chert	Bathyal zone	[285]
441	Paleozoic	Ordovician	Middle	Darriwilian	Grondines, Quebec, Canada	N 46°14', W 72°01'	-29.793	U- or J-form spiraling spreiten (H)	3–4		1	5×10×c	Limestone	Shallow shelf	[286]
442	Paleozoic	Ordovician	Middle	Dapingian	St. Lawrence Lowland, Canada	N 45°30', W 73°04'	-27.04	Flat spirally coiled spreiten (H)	3–5		1	6×8×c	Micrite and argillaceous calcisiltites	Shallow shelf	[286]
443	Paleozoic	Ordovician	Middle	Dapingian	Wuhai, NW of Ordos Basin, China	N 39.3795°, E 106.8932°	-21.08	J-form spiraling spreiten (H)	3–5		1	8×14×c	Marlite	Bathyal zone	[287]
444	Paleozoic	Cambrian	Epoch 3	Drumian?	Pal ác Hill, Czech	N 49°56', E 15°40'	-43.64	Planar spreite (S)	2–3				Siltstone	Lower offshore	[288]
445	Paleozoic	Cambrian	Epoch 2	Age 3	Xuzhou, Jiangxu, China	N 34°03', E 117°03'	-4.89	Arcute spirally coiled spreiten (H)	4–5		1	13×10×c	Sandstone	Lower offshore	[289]
446	Paleozoic	Cambrian	Epoch 2	Age 3	Xuzhou, Jiangxu, China	N 34°03', E 117°03'	-4.89	Tongue-like spreiten (H)	3		2	15×b×c	Sandstone	Lower offshroe	[289]
447	Paleozoic	Cambrian	Epoch 2	Age 3	Tayshir I, Mongolia	N 46°40', E 96°29'	3.83	Circular spiraling spreiten					Sandstone	Lower shoreface	[290]
448	Paleozoic	Cambrian	Terreneuvian	Fortunian	Death Valley region, California, USA	N 36°08.5', W 116°09'	5.13	Arcute spirally coiled spreiten (H)		0.6	1	8.1×b×c	Siltstone	Subtidal	[291]

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