http://app.pan.pl/SOM/app69-Ishizaki_Shiino_SOM.pdf

SUPPLEMENTARY ONLINE MATERIAL FOR

A new genus of Triassic discinid brachiopod and re-evaluating the taxonomy of the group—evolutionary insights into autecological innovation of post-Palaeozoic discinids

Yoshino Ishizaki and Yuta Shiino

Published in *Acta Palaeontologica Polonica* 2024 69 (3): 529-548.
https://doi.org/10.4202/app.01164.2024

Supplementary Online Material

Table S1. Morphological characteristics of post-Palaeozoic discinid genera and selected Palaeozoic species.

Table S1. Morphological characteristics of post-Palaeozoic discinid genera.

Number	Genus	Size	Outline	Outline of each margin	Shape of lateral view	Height	Convexity	Apex position	Dorsal shell slope	Ventral shell slope	Dorsal ornamentation	Costellae (dorsal)	Pustule (dorsal)	Ventral ornamentation	Pedicle track and listrium	Large depressed area	Shape of the larval shell (protegulum)	Age	Locality	Taxonomic note	Occurrence	Shell type	Reference
1	*Orbiculoidea winsnesi* Gobbett, 1963	L: 4 mm W: 3.6 mm	subcircular, length slightly greater than width					D: 1/3 of the diameter from anterior margin	A: convex		faint and fine concentric growth lines							Induan (Griesbachian), Early Triassic	Svalbard		attached to an ammonoid in laminated black shales	---	Foster et al., 2017
2	*Orbiculoidea yangkangensis* Xu and Liu, 1983	W: 8.4–13.0 mm	subcircular			1.9–3.7 mm	dorsibiconvex	D: biassed towards posterior margin V: subcentral		A: gently convex P: gently convex	fine concentric growth lines				shorter than 1/4 of the width, linear			middle Anisian	North-western China		clastic rocks intercalated with limestone	---	Xu and Liu, 1983
2	*Orbiculoidea yangkangensis* Xu and Liu, 1983	16.3 mm	subcircular		conical			D: eccentric, 1/3 of shell posterior	A: strongly convex P: convex		fine concentric growth lines, stronger around apex	faint						Changhsingian, Late Permian	South China		limestone in calcareous mudstone	---	Zhang et al., 2014
3	*Orbiculoidea qieermaensis* Xu and Liu, 1983	W: 16.5–17.3 mm	subcircular			3.1–4.2 mm	biconvex?	D: 1/3 of length from posterior margin V: near the posterior margin	convex, relatively flat outer margin ring	convex?	concentric wrinkle more obvious in the middle of the shell				very short structure, length about 1/8 of the width			middle Anisian	North-western China		clastic rocks intercalated with limestone	---	Xu and Liu, 1983
4	*Orbiculoidea taskrestensis* Dagys, 1985	up to 35 mm	close to round		low	less than 10 mm	convexoconcave	D: eccentric, 1/3 of the length from posterior margin V: central or slightly eccentric	A: moderately convex P: flat-moderately convex	A: concave P: flattened in the lateral, convex in the axial part?	distinct concentric growth lines				less than half of the distance between apex and posterior margin, very narrow	V-shaped despressed area		Early Anisian	Siberia			A1	Dagys and Kurushin, 1985
5	*Discinisca lamellosa* (Broderip, 1833)	15–23 mm	sub-circular, slightly elongate oval			about 4 mm	convexoplane-convexoconcave	D: subcentral, 1/3 of the length from posterior margin V: central	A: moderately convex P: flat-concave	A: convex P: concave (partially xenomorphic)	lamellose shell with concentric growth lines			indistinct lamellose shell with smooth and slightly convex around apex	Oval or elongate whitish area with wide foramen, 1/3 length and 1/2 width Median plate: faint growth lines aligning the curvature of pedicle foramen Semilunar plate: faint growth lines	U-shaped depressed area	D: circular and smooth	extent	Ancon Bay, Peru		formed layered clusters on a sandy substrate, depth of 9-17 m	A2	Broderip, 1833 Dall, 1871 Mergl, 2010
6	*Discinisca laevis* (Sowerby, 1822)	27–30 mm	subcircular				convexoplane	D: 1/4-1/5 from posterior margin V: 1/3-1/4 from posterior margin	A: convex P: nearly flat	A: moderately convex P: flat to concave	smooth, indistinct lamellose shell			indistinct lamellose shell with smooth and slightly convex around apex	Oval or elongate whitish area with wide foramen, 1/4 length and 1/2 width Median plate: faint growth lines aligning the curvature of pedicle foramen Semilunar plate: faint growth lines	U-shaped depressed area	D: moderately convex, smooth, 0.5 mm diameter	extant	Peru; Chile		grape-like cluster colonies of small and medium specimen adhere a large host specimen	A2	Mergl, 2010
7	*Discinisca tenuis* (Sowerby, 1847)		subcircular, slightly trapezoid	short, straight posterior margin				D: 1/10 from posterior margin V: 1/3 from posterior margin	A: convex	A: plane to gently convex P: concave	smooth, slightly lamellose shell with concentric growth lines and slightly radial wrinkles			smooth and indistinct lamellose shell with slightly radial wrinkles	narrow longitudinal pedicle foramen with V-shaped wide pedicle track	U-shaped wide depressed area, extending to postero-lateral part		extant	Namibia, Africa			A2	Sowerby, 1847
8	*Pelagodiscus atlanticus* (King, 1868)		circular		conical			subcentral and posterior half	lateral convex		smooth shell with fine, regular concentric growth lines							Miocene(?) to extant	deep sea (about 2548 m)			A3	King, 1868 Dall, 1908 Holmer and Popov, 2000
9	*Discinisca fallens* (Wood, 1872)	L: 1.6–4.8 mm W: 1.5–3.1 mm	subcircular, more or less elongated	rounded	conical	1.5 mm	convexoplane?	D: posteriorly subcentral to 1/3 of the length from posterior margin	A: flat-concave P: flat-moderately convex		smooth, slightly lamellose shell with very fine concentric growth lines						D: circular and smooth	Oligocene; Miocene; Pliocene	North Sea; Atlantic Ocean			A	Dulai and Hocht, 2020 Bitner and Müller, 2022
10	*Discinisca singewaldi* Schuchert, 1917 in Berry, 1917	L: 9–10 mm W: 7–11 mm	circular to elongate oval	near posterior margin of dorsal valve is straight		2.5–4 mm	convexoplane	D: posterior marginal or posteriorly sticking out of the shell outline V: subcentral to subposterior	moderately convex	flat	partially lamellose shell, showing band-like ornamentation, with concentric growth lines				narrow and long pedicle track, extending to posterior margin, long wide pedicle foramen	large moderately depressed area in the posterior slope?		Miocene or Pliocene	Bolivia			A2	Berry, 1917
11	*Discinisca insularis* Muir-Wood, 1939				very depressed conical valve						nine narrow concentric lines in original illustration (lamella, rugae or bands?)							Eocene		Possible synonym of *D. townshendi* is still under consideration.		A	Muir-Wood, 1939 Dulai and Hocht, 2020
12	*Discinisca leopolitana* (Friedberg, 1921)	L: 5.5–7.0 mm W: 6.6–9.0 mm	generally circular, sometimes slightly rectangular		low conical			D: subcentral?			numerous dense concentric growth lines, showing faint bands						D: smooth, 0.6 mm diameter	Middle Miocene	Ukraine; Poland (Central Paratethys)			A	Friedberg, 1921 Dulai, 2015 Dulai and Hocht, 2020
13	*Discinisca aldrichi* (Gardner, 1928)	L: 9.5 mm W: 9.5 mm	oval to elliptical			2.5 mm		D: posterior, 1/20 of length from posterior margin			concentric growth lines in varying shades of brown laminae decrease at the margin and around apex							Miocene	Florida, USA			A	Cooper, 1988 Gardner, 1928 Stenzel, 1964
14	*Discinisca porvenir* Pérez et al., 2023	L: 20–27 mm W: 16–21.6 mm	subcircular to subtrapezoidal, slightly elongate	nearly straight and smooth posterior and anterior margins, narrower than the rest of the outline	low conical		convexoplane	D: posterior, 1/5 of length from posterior margin	slightly depressed around brephic shell with a lower slope around neanic shell	flat	peripherally glossy, lamellose shell with narrow concentric growth lines						D: smooth and subcircular to subquadrate outline	Early Miocene	Chubut Province, Argentina			A	Pérez et al., 2023
15	*Discinisca messii* Pérez et al., 2023	L: 23–24 mm W: 21–22 mm	subcircular to circular, slightly elongate		low doomed and rounded		convexoplane	D: posterior, 1/10 of length from posterior margin V: slightly posterior	slightly depressed around brephic shell with a lower slope around neanic shell	A: plane to gently convex P: concave	glossy, slightly lamellose with very shallow concentric lines			regular and narrow-arranged concentric glossy lamellae with tiny pits	narrow, elongated triangular pedicle slit extending to posterior margin	U-shaped depressed area in the posterior slope	D: smooth and subcircular	Early Miocene	Chubut Province, Argentina			A2	Pérez et al., 2023
16	*Discinisca variabilis* Thomson, 1971	6–20 mm	subcircular to oval, and truncated posteriorly		low conical and asymmetrically conical			D: posterior, 1/4 of the length from posterior margin	A: convex P: concave		periodic coarse concentric corrugations with fine growth lines						D: circular	Early Cretaceous	Alexander Island			A	Thomson, 1971
17	*Discinisca vistulae* Radwańska and Radwański, 1994	L: 12.03 mm W: 9 mm	elongated anteriorly		triangularly at the apex, dome-like, posteriorly	7.0 mm		D: posteriorly	A: moderately convex P: slightly concave		strong fine concentric growth lines, showing bands						D: subcircular to slightly elongate	Late Cretaceous	Poland	This species is included in the subgenus "*Arquinisca*".		A	Radwańska and Radwański, 1994
18	*Discinisca undata* Smirnova et al., 2017	L: 2.0–2.2 mm W: 2.1–2.3 mm (max 7 mm)	rounded trapezoid, rarely rounded square		low conical		convexoplane	D: subcentral, slightly shifted posteriorly	slightly convex		shell with square pits and concentric growth lines				narrow, straight, extending to posterior margin		D: circular and smooth, 0.12-0.15 mm diameter (embryonic shell)	Late Jurassic	Western Siberia		The posterior thirds of both valves form two steep undulate deflections	A	Smirnova et al., 2017
19	*Discinisca kawhiana* (Boehm, 1911)	4 mm	round					V: subcentral			concentric wavy undulation			fine concentric growth lines	narrow slit-like furrow, extending to 1/7 long from posterior margin, both sides of the slit are depressed	possible large depressed area		Late Jurassic (Puaroan)	Kawhia, New Zealand		attached to *Lima* (*Plagiostoma*)	A	Boehm, 1911 Lee, 1987 Smirnova et al., 2017
20	*Discinisca suborbicularis* Smirnova et al., 2017	1.65–4.60 mm	subcircular, slightly elongated			0.8 mm		D: subcentral, rarely displaced slightly posteriorly, large, rounded umbo	convex		smooth shell with fine concentric growth lines							Late Jurassic	Western Siberia			A	Smirnova et al., 2017

21	*Discinisca papyracea* (Münster in Goldfuss, 1831)	8–12 mm	subcircular					D: subcentral to subposterior V: posterior, 1/3 of length from posterior margin			concentric growth lines		costellae with fine concentric growth lines	inverted triangle shape	V-shaped large depressed, extending and widening to posterior margin		Toarcian, Early Jurassic	Holzmaden, Germany		attached to ammonoid	A2	Seilacher, 1982 Bitner et al., 2010 Hölflinger, 2020
22	*Discinisca reflexa* (Sowerby, 1829)	L: 15 mm W: 10-13 mm	oval, pointed to posterior (dorsal)			5 mm	convexoconcave	D: directed towards and subposterior, 1/5 to 1/6 V: subcentral-subposterior	A: convex P: slightly convex-flat	A: flat P: concave behind the apex	smooth or indistinct lamellose shell with or without fine concentric growth lines		concentric growth lines	a long, teardrop foramen, extending to posterior margin	V-shaped depression, extending and widening to posterior margin		Early Jurassic	Britain	Species name "*reflexa*" is doubtful based on discussion by Muir-Wood (1936), but original description of "*reflexa*" shows well-preserved ventral valve.	clay ironstone nodules, attached to *Nucula ovum*, inferior Oolite	A2	Sowerby, 1829 Davidson, 1851 Muir-Wood, 1929
23	*Discinisca holdeni* (Tate, 1867)	L: 4–5 mm W: 3–6 mm	circular		conical	2–3 mm	convexoplane	D: posteriorly subcentral		flat	fine concentric growth lines		faint concentric growth lines and costellae	circular or oval area with elongate foramen			Hettangian, Early Jurassic	Dorset, Britain		usually attached to *Cardinia ovalis*, *Astarte consobrina* and *Ammonoites*	A2	Tate, 1867 Muir-Wood, 1929 Muir-Wood, 1936
24	*Discinisca langi* Muir-Wood, 1936	L: 22.5 mm W: 28 mm	circular							slightly concave	concentric growth lines, showing broad rugae		broad concentric growth lines	missing			Early Jurassic	Dorset, Britain			A	Muir-Wood, 1936 Biernat, 1995
25	*Discinisca townshendi* (Davidson, 1851)	40 mm	circular, slightly widened laterally	regularly rounded		16 mm, greatest elevation of the valve towards the central part, the apex lying considerably lower	convexoconcave	D: almost close to the posterior margin V: subcentral	A: strongly convex P: concave	slightly concave	smooth shell with irregular concentric growth lines (fila?)		numerous and distinct, slightly-elevated concentric growth lines	long, wide, ovular track, 13 mm long and 5.5 mm wide	deep V-shaped depression posterior to the apex		Jurassic	Britain		Oolite	A1	Davidson, 1851
25	*Discinisca babeana* (d'Orbigny, 1849)	40 mm									faint						Rhaetian, Late Triassic	Austrian alps, central France	Synonym of *D. townshendi* (*nomen nudum*)		A1	Deslongchamps, 1862 Radwanski and Summesberger, 2001
26	*Discinisca rhaetica* (Andreae, 1893)	32 mm	sub-circular, slightly wider posteriorly	near posterior margin straight	low conical, broad		convexoconcave	D: subcentral, almost 1/3 of the length from posterior margin V: subcentral, slightly anteriorly	A: moderately convex P: slightly concave, margins wide, flattened	concave	almost regular spacing (smooth?), fine numerous concentric growth lines		fine concentric growth lines	longitudinal track extending to posterior margin, with parallel margins, slightly widen posteriorly	narrow V-shaped area without any growth lines (based only on original illustration)		Rhaetian, Late Triassic	Baden-Württemberg, Germany			A1	Andreae, 1893 Schmidt, 1938
27	*Discinisca suessi* (Gümbel, 1861)	30 mm				10 mm					smooth shell with strongly elevated concentric growth lines						Middle Triassic	Muschelkalk, Germany			A	Gümbel, 1861 Radwański and Summesberger, 2001 Bitner et al., 2010
28	*Discinisca discoides* (Schlotheim, 1820)		subcircular	posterior margin slightly straight				D: posterior, 1/5 of length from posterior margin V: subcentral			smooth shell with concentric growth lines		fine concentric growth lines	narrow elongate, not extending to posterior margin	V-shaped large depressed area		Early to Middle Triassic	Muschelkalk, Polish; Germany		attached to ammonoid	A1	Bittner, 1890 Radwański and Summesberger, 2001 Bitner et al., 2010 Baets et al., 2015
29	*Discinisca sibirica* (Moisseiev, 1947)	L: 11.5–14 mm W: 10.5–14 mm	elongate-oval, length greater than width		cap-shaped	4.5–6.5 mm	convexoconcave	D: almost close to posterior margin, 1/5-1/9 of the length from posterior margin V: subcentral	A: strongly convex P: flat to slightly convex	A: concave P: nearly flat?	smooth shell with partly visible faint growth lines		faint concentric growth lines	longitudinal fissure, with pedicle track extending and a little widening from the apex to posterior margin	V-shaped depression(?) extending and widening to posterior margin		Anisian and Carnian, Triassic	Northern Siberia			A1	Dagys, 1965 Dagys and Kurushin, 1985
30	*Bronzoria recta* gen. et sp. nov.	L: 7–12 mm W: 6–14 mm	sub-circular to elongate-oval	regularly rounded	low conical	1.08–2.09 mm (maximum estimation because of compaction)	convexoconcave	D: eccentric, 1/3-1/4 of the length from posterior margin V: central	A: convex P: concave	A: nearly flat P: concave	distinct fine concentric lines and 2–3 fila/mm		numerous and distinct, slightly elevated concentric growth lines, fila 2–3/mm	narrow, straight furrow	V-shaped depression, extending and widening to posterior margin	D: oval and smooth, 0.6 mm diameter V: heart-shaped concave with a ridge of posterior midline, 0.5 mm diameter					A1	this study
31	*Discinisca major* (Wagner, 1913)	43 mm	sub-elongate, elongate-oval		low conical		convexoplane?	D: 1/4 from posterior margin V: subcentral-subposterior			irregular concentric growth lines		fine concentric growth lines				Ladinian (Upper Muschelkalk), Middle Triassic	Bönnigheim-Hohenstein, Gernany		hard dolomite, yellow, flat weathered above	A	Wagner, 1913
32	*Discinisca bosniaca* (Kittl, 1904)	up to 30 mm	circular, sub-elongate		low conical		convexoplane	D: 1/4-1/5 from posterior margin V: subcentral-subposterior	A: modelately convex P: flat	A: flat P: concave	concentric growth lines, with 3.5–4 mm interval of neighboring two fila		concentric growth lines	long, narrow track, extending to posterior margin	V-shaped depression, extending and widening to posterior margin	D: smooth V: smooth	late Permian	Bellerophon Formation, Bosnia		articulated shell, sandy marl with dark limestone banks	A1	Kittl, 1904
33	*Discradisca strigata* (Broderip, 1833)		subcircular	posterior margin straight to slightly dented			convexoplane	D: 1/5 of the length from the posterior margin			smooth shell with or without faint concentric growth lines	distinct	costellae		very large "peduncular area"		extant	Cana Island; California; Guatemala; Panama	bold radial stripes of dark colour widening to margin are remarkable	attached to rocks, depth of 33 m living as a cluster	B3	Broderip, 1833 Dall, 1920
34	*Discradisca sparselineata* (Dall, 1920)	L: 6.5 mm W: 6.3 mm (up to 9 mm)	variable in outline, unevenly subcircular, irregular	posterior margin nearly straight		3 mm	convexoplane?	D: posteriorly, 1/5 of the length from posterior margin			smooth shell with or without faint concentric growth lines	rare	sparse, fine costellae outside of pedicle area		very large heart-shaped depressed area		extant	Japan; French Polynesia		96–300 m depth	B3	Dall, 1920 Bitner, 2014
35	*Discinisca sendaiensis* Hatai and Hayasaka, 1965	L: 20.8 mm W: 19.4 mm	sub-circular to elongate	posterior margin moderately straight	conical	8.8 mm		D: subposterior, 1/3 of the length from posterior margin, pointed apex	A: slightly convex P: flat to slightly concave		fine, irregular concentric growth lines with broad concentric lamellae	faint					early Pliocene	Sendai, Japan			B	Hatai and Hayasaka, 1965
36	*Discradisca miyagiensis* (Hatai and Hayasaka, 1965)	L: 10.7–13.8 mm W: 9.9–12.8 mm	roughly circular, elongate	posterior margin rounded		4.5–6.2 mm		D: subcentral, slightly posteriorly, pointed apex	A: flat to slightly concave P: strongly convex		concentric growth lines, sometimes showing thin bands?	faint					early Pliocene	Miyagi, Japan			B	Hatai and Hayasaka, 1965
37	*Discinisca elslooensis* Radwańska and Radwański, 2003	7–11 mm	almost subcircular, but tending to quadrangular	some of specimens posterior margins tend to straight, lateral margins also irregularly straight	low conical		convexoconcave	D: almost close to posterior margin or more posterior than posterior margin(?) V: subposterior, to fully posterior	A: flat to slightly convex P: slightly concave-moderately convex	flat-concave	smooth but slightly lamellose shell with concentric growth lines showing bands	faint	lamellose shell, stronger around anterior margin	narrow track, extending and slightly widening posteriorly, with elevated parallel margin of the track	very small, U-shaped depression with faint boundary, sometimes forming clear boundary by means of deep depression with bending		Middle Miocene	Netherlands		Elsloo Conglomerate, the complete shells usually preserved with their two valves conjoined in life position	B2	Radwańska and Radwański, 2003 Dulai and Hocht, 2020
38	*Discradisca lugubris* (Conrad, 1834)		subcircular					D: posterior, 1/10 of length from posterior margin			fine wrinkles and concentric growth lines showing fila?	faint					Pliocene	Maryland; Florida			B	Conrad, 1834 Conrad, 1845 Gardner, 1928 Stenzel, 1964
39	*Discinisca spitsbergensis* Biernat, 1995	up to 12 mm	sub-circular to oval	posterior margin evenly straight	low conical		convexoplane	D: subposterior, 1/3 of the length from posterior margin V: subcentral	A: convex P: nearly flat to moderately convex	A: flat P: concave of trigonal large depressed area	faint irregular concentric growth lines, usually with 2 fila/mm	faint	fine concentric growth lines	narrow track, extending and moderately widening to posterior margin, with elevated parallel margin of the track	wide V-shaped strongly depressed area, extending and widening to posterior margin		Toarcian to Aalenian, Jurassic	Central Spitsbergen		phosphorite nodules	B1	Biernat, 1995
40	*Discinisca cellensis* (Suess, 1854)		subcircular	posterior and anterior margins are slightly straight	conical, angle at the apex is about 135°			D: subcentral, almost 1/3 of the length from posterior margin			fine concentric growth lines	distinct					Late Triassic	Mariazeller Bürgeralpe, Austria			B	Suess, 1854
41	*Discinisca zapfei* Radwański and Summesberger, 2001	L: 15–24 mm W: 13–24 mm	sub-circular, slightly widened laterally		low conical		convexoplane?	D: subposterior, 1/5 of the length from posterior margin V: central	A: convex P: concave	A: flat P: concave	fine concentric growth lines with 2–2.5 mm interval of neighboring two	faint	faint concentric growth lines	narrow track with parallel margins, extending and slightly widening to posterior	V-shaped strongly depressed, extending and	D: oval and smooth, 0.7 mm diameter V: smooth	Norian to Rhaetian, Late Triassic	Alps, Austria		adhering to the rock slab, marly limestone	B1	Radwański and Summesberger, 2001

											fila			margin	widening to posterior margin						
42	*Discinisca* cf. *zapfei*	up to 23 mm	sub-circular, slightly elongate-oval, longer than wide		low conical		convexoplane	D: posteriorly subcentral V: subcentral	weakly convex, strongly convex near apex	A: flat P: slightly concave?	numerous, fine concentric growth lines	faint		faint concentric growth lines	elongate, oval track with narrow pedicle foramen?	V-shaped slightly depressed, extending and widening to posterior margin	D: smooth about 0.4 mm diameter	Carnian, Late Triassic	Julian Alps, Slovenia		bituminous cherty limestone, adhering to the rock	B1	Bitner et al., 2010
43	*Discradisca stella* (Gould, 1862)	up to 5.4 mm	nearly circular	posterior margin more or less straight	conical		convexoplane-convexoconcave?	D: subcentrally, up to 1/3 of the length from posterior margin	concave inside brephic shell, flat to slightly convex? toward margin		smooth shell with faintly fine concentric growth lines, pustule at the intersections of the costellae and the growth lines	distinct		densely-arranged fine costellae		large heart-shaped depressed area	D: smooth	extant	Japan; China; northern Australia; New Caledonia		105–110 m depth	C	Dall, 1920 Bitner, 2010
44	*Discradisca antillarum* (d'Orbigny, 1846)	L: 7.8–12.0 mm W: 6.7–8.0 mm	unevenly subcircular	square outline	low conical	2.8–4.0 mm	convexoconcave	D: subposterior, 4/7 of the length from posterior margin	A: gently, slightly convex P: gently, slightly convex	concave medially by gently convex marginally	coarser, irregular concentric growth lines	distinct	present	densely-arranged fine costellae	Circular (?) area with narrow foramen of 1/4 to 1/3 length of shell	large heart-shaped depressed area		extant	Mexico; Texas; Caribbean Sea		western Gulf from warm temperate water in the north to tropical waters in the south. Shallow-water, submarine banks, 14–16 m depth	C3	Dall, 1920 Tunnell, 1982
45	*Discradisca indica* (Dall, 1920)	L: 2.3–4.1 mm W: 2.1–5.0 mm	subcircular to oval (triangular ventral)	margins often irregular	conical		convexoconcave-convexoplane	D: subposteriorly, 1/4 of the length from posterior margin V: nearly central, slightly subanterior	convex near the margin	concave medially and slightly convex marginally	numerous concentric growth lines	distinct	present	faint growth lines and widely-spaced granular costellae, increasing the number by bifurcation up to 13–19	Circular or oval area with elongate foramen of 1/2 to 1/3 length from apex to posterior margin Median plate: faint growth lines aligning the curvature of pedicle foramen	subcircular to heart-shaped depressed area with faint concentric growth lines	D: smooth	extant	India; Sri Lanka; Persian Gulf		5–30 m depth, attached to oyster shells	C3	Dall, 1920 Bitner et al., 2008
46	*Discradisca cumingi* (Broderip, 1833)		subcircular to slightly elongate				convexoplane	D: 1/3-1/4 of the length from the posterior margin		variable	distinct lamellose shell	distinct		lamellose shell with faint costellae	large pedicle area			Pliocene; extant	Peru; Panama; Mexico		attached to the lower sides of stones in sandy mud at low water, 10 m depth	C3	Broderip, 1833 Dall, 1920 Hatai and Hayasaka, 1965
47	*Discinisca* (?) *rikuzenensis* Hatai, 1940	L: 3.0 mm W: 3.5 mm	squarely rounded	posterior margin more or less straight, lateral sides subparallel, anterior margin arched, evenly rounded				D: subcentral, directed anteriorly			strong fine concentric growth lines, showing wide bands							extant	Rikuzen, north-eastern Japan		36 m depth	C	Hatai, 1940
48	*Discradisca kamikatetsuensis* (Yabe and Hatai, 1935)	L: 14.0 mm W: 13.0 mm	subcircular	margins more or less irregular		6.0 mm		D: posterior			concentric growth lines	distinct	present				D: circular and smooth	Early Pleistocene	Ryukyu Islands, Japan			C	Hatai, 1940 Bitner and Cahuzac, 2013
49	*Discina striata* (Schumacher, 1817)		irregularly subcircular				biconvex-convexoconcave	D: subcentral V: subcentral			concentric growth lines	distinct (swirling)			small, narrow pedicle track			extant	western coast of Africa		less than 50 m depth, with ventral valve cemented to substrate,	C	Schumacher, 1817 Emig, 1997 Holmer and Popov, 2000
50	*Discradisca polonica* (Radwańska and Radwański, 1984)	L: 3.2–5.0 mm W: 3.0–4.0 mm	circular to elongate		low conical		convexoplane?	D: slightly displaced posteriorly	A: flat to slightly concave P: concave, irregularly depressed		distinct concentric growth lines	distinct	present				D: smooth	Middle Miocene	Central Poland		fossiliferous clay	C	Radwańska and Radwański, 1984 Dulai, 2015
51	*Discradisca multiradiata* (de Morgan, 1915)	L: 2.7–8.6 mm W: 2.6–6.1 mm	variable in outline from sub-circular to ovally elongate	posterior margin usually more or less straight lateral margin strongly irregular in some specimens	low to moderate conical		convexoconcave	D: 1/4-1/5 of the length from posterior margin	A: slightly convex P: slightly convex Lateral: flat and more elevated than anterior and posterior slope		numerous, distinct concentric growth lines	distinct					D: smooth about 0.4 mm diameter	Miocene	France; Belgium		lagoonal carbonate sands	C	Muir-Wood, 1929 Bitner and Cahuzac, 2013
52	*Discinisca oregonensis* Dall, 1909	up to 35 mm	subcircular, slightly widened laterally			8–9 mm		D: subcentral	concave around apex, flat to slightly convex toward margin		faint concentric growth lines, showing bands	distinct						Miocene	Coos Bay, Oregon			C	Dall, 1909 Muir-Wood, 1929
53	*Discradisca multilineata* (Conrad, 1845)		suboval		compressed			D: subposterior, 1/5 of length from posterior margin	surface uneven		lamellose shell with concentric growth lines and fine wrinkles	distinct						Neogene	Maryland			C	Conrad, 1845 Muir-Wood, 1929
54	*Discradisca scutellum* (Dreger, 1889)	about 4 mm	subcircular, with square margin	posterior and lateral margins more or less straight	low conical			D: subcentral, slightly posteriorly	A: slightly concave P: slightly concave		numerous fine, regular concentric growth lines	distinct	present				D: smooth	Langhian (Middle Miocene)	Austria			C	Kroh, 2003 Dulai and Hocht, 2020
55	*Discradisca carpathica* (Čtyroký and Fejfar, 1963)	up to 30 mm										distinct						Neogene				C	Dulai, 2015 Dulai and Hocht, 2020
56	*Discradisca steiningeri* (Radwańska and Radwański, 1989)	9-12 mm maximum 16 mm	irregular subcircular, more or less elongated to almost rectangular, variable	tendency to have the posterior margin straightened, slightly indented at midline	low conical	3.0–4.6 mm		D: subposterior to almost posterior, 1/4-1/7 of the length from posterior margin, pointed apex	A: more or less irregularly convex P: flat to slightly concave		lamellose shell with fine concentric growth lines, partially showing smooth surface	distinct					D: hardly recognized (damaged)	Egerian (late Oligocene)	Austria		ferruginous sand bed	C	Radwańska and Radwański, 1989
57	*Discinisca davisi* Muir-Wood, 1939	3 mm										distinct						Middle Eocene	Britain			C	Muir-Wood, 1939 Williams et al., 1998 Dulai and Hocht, 2020
58	*Discradisca ferroviae* (Muir-Wood, 1929)	L: 8–10 mm W: 8–10 mm	circular	narrowing posteriorly		1.5–2 mm	convexoplane?	D: subcentral to subposteror, depressed apex	A: slightly convex P: slightly convex		numerous concentric growth lines	distinct	present				D: smooth	Eocene	London, England		attached to oyster rock and the *Cyrena* marls, or sands with *Ostrea*	C	Muir-Wood, 1929
59	*Discradisca littigensis* Stenzel, 1964	L: 6.9–8.8 mm W:6.6–9.1 mm	circular to oval	anterior margin is more narrowly rounded than the posterior margin	conical	2.8–4.8 mm	convexoplane?	D: subposterior, 2/5 of the length from posterior margin	A: slightly convex P: slightly convex		slightly elevated, irregular concentric growth wrinkles	distinct					D: smooth	Danian, Paleocene	Texas		phosphorite-cobble paraconglomerate at base	C	Stenzel, 1964
60	*Discinisca humphresiana* (Sowerby, 1829)	L: 7–12 mm W: 7–12 mm	circular to slightly elongate		conical	4 mm	convexoplane-convexoconcave?	D: subposterior, 1/3-1/4 of the length from posterior margin	A: flat to slightly convex P: flat-concave		faint concentric growth lines, showing bands	distinct						Late Jurassic	Dorset, Britain		attached to *Ostrea deltoidea* from the Kimmeridge Clay of Shotover make cluster	C	Sowerby, 1829 Davidson, 1851

In the last column of "Shell type", previous studies classified A, B and C, while this study classified 1, 2 and 3 if evidence of ventral valve presents. See Fig. 10. L: length, W: width, D: dorsal, V: ventral, A: anterior, P: posterior.

References in Table S1

Andreae, A. 1893. Die Brachiopoden des Rhät von Malsch. *Mitteilungen der Grossherzoglich Badischen Geologischen Landesanstalt* 3: 11–17.

Baets, K.D., Keupp, H., and Klug, C. 2015. Parasites of ammonoids. *In*: C. Klug, D. Korn, K. De Baets, I. Kruta and R.H. Mapes (eds.), *Ammonoid Paleobiology: from Anatomy to Ecology*, 837–875. Springer, Dordrecht.

Berry, E.W. 1917. Fossil plants from Bolivia and their bearing upon the age of uplift of the eastern Andes. *Proceedings of the United States National Museum* 54: 103–164.

Biernat, G. 1995. A new Jurassic discinid brachiopod from Spitsbergen. *Polish Polar Research* 16: 37–46.

Bitner, M.A. 2010. Biodiversity of shallow-water brachiopods from New Caledonia, SW Pacific, with description of a new species. *Scientia Marina* 74: 643–657.

Bitner, M.A. 2014. Living brachiopods from French Polynesia, Central Pacific, with descriptions of two new species. *Pacific Science* 68: 245–265.

Bitner, M.A. and Cahuzac, B. 2013. New record of *Discradisca* (Brachiopoda: Discinidae) from the Early Miocene of the Aquitaine Basin, south-western France. *Comptes Rendus Palevol* 12: 23–29.

Bitner, M.A., Jurkovšek, B., and Kolar-Jurkovšek, T. 2010. New record of the inarticulate brachiopod genus *Discinisca* from the Upper Triassic (Carnian) of the Julian Alps, NW Slovenia. *Neues Jahrbuch fur Geologie und Paläontologie-Abhandlungen* 257: 367–372.

Bitner, M.A., Logan, A., and Gischler, E. 2008. Recent brachiopods from the Persian Gulf and their biogeographical significance. *Scientia Marina* 72: 279–285.

Bitner, M.A. and Müller, A. 2022. Early Oligocene brachiopods from the rocky-shore deposits at Mammendorf, central Germany. *Annales Societatis Geologorum Poloniae* 92: 87–107.

Bittner, A. 1890. Brachiopoden der alpinen Trias. *Abhandlungen der Kaiserlich-Königlichen Geologischen Reichsanstalt* 14: 1–325.

Boehm, G. 1911. Grenzschichten zwischen Jura und Kreide von Kawhia (Nordinsel Neuseelands). N*eues Jahrbuch für Mineralogie, Geologie und Paläeontologie* 1: 1–24.

Broderip, W.J. 1833. Descriptions of some new species of Cuvier's family of Brachiopoda. *Proceedings of the Zoological Society of London* 1: 141–144.

Conrad, T.A. 1834. Descriptions of new Tertiary fossils from the southern states. *Journal of the Academy of Natural Sciences of Philadelphia, Series 1* 7: 130–157.

Conrad, T.A. 1845. *Fossils of the Tertiary formations of the United States*. 89pp. J. Dobson, Philadelphia.

Cooper, G.A. 1988. Some Tertiary brachiopods of the east coast of the United States. *Smithsonian Contributions to Paleobiology* 64: 1–45.

Čtyroký P. and Fejfar, O. 1963. Fauna der Sande und Sandsteine der karpatischen Formation (Mittelmiozän) bei Dolni Netcice in der Karpatenvortiefe [in Germany]. *Geologické Práce* 27: 143–168.

Dagys, A.S. 1985. The Triassic brachiopods and bivalves of the north of Central Siberia [in Russian]. *Transactions of Geology and Geophysics. Siberian Branch* 633: 1–160.

Dagys, A.S. and Kurushin, N.I. 1985. *Triassic Brachiopods and Bivalves of the North Middle Siberia* [in Russian]. 160 pp. Nauka, Moscow.

Dall, W.H. 1871. Report on the Brachiopoda obtained by the United States Coast Survey Expedition, in Charge of L. F. DE POURTALES, with a revision of the Craniidae and Discinidae. *Bulletin of the Museum of Comparative Zoology at Harvard College* 3/1: 1–45.

Dall, W.H. 1908. The Mollusca and the Brachiopoda. *Harvard University, Museum of Comparative Zoology, Bulletin (Cambridge)* 43: 205–487.

Dall, W.H. 1909. Contributions to the Tertiary paleontology of the Pacific coast: I. The Miocene of Astoria and Coos Bay, Oregon. *United States Geological Survey Professional Paper* 59: 1–278.

Dall, W.H. 1920. Annotated list of the recent Brachiopoda in the collection of the United States National Museum, with descriptions of thirty-three new forms. *Proceedings U. S. National Museum* 57: 261–377.

Davidson, T. 1851. A monograph of the British fossil Brachiopoda. Part III. The Oolitic and Liasic Brachiopoda. *Monographs of the Palaeontographical Society* 4: 1–64.

Deslongchamps, E. 1862. Études critiques sur des Brachiopodes nouveaux ou peu connus [in French]. *Bulletin de la Société Linnéenne de Normandie* 7: 248–297.

Dreger, J. 1889. Die tertiären Brachiopoden des Wiener Beckens. *Beiträge zur Paläontologie Österreich-Ungarns und des Orients* 7: 179–192.

Dulai, A. 2015. Central Paratethyan middle Miocene brachiopods from Poland, Hungary and Romania in the Naturalis Biodiversity Center (Leiden, The Netherlands). *Scripta Geologica* 149: 185–211.

Dulai, A. and Hocht, F.V.D. 2020. Upper Oligocene brachiopods from NW Germany, with description of a new platidinae genus, *Germanoplatidia* n. gen. *Rivista Italiana di Paleontologia e Stratigrafia* 126: 223–248.

Emig, C.C. 1997. Biogeography of inarticulate brachiopods. *In* R.L. Kaesler (ed.), *Treatise on Invertebrate Paleontology, Part H: Brachiopoda Revised Volume 1*, 497–502. Geological Society of America and University of Kansas, Boulder and Lawrence.

Foster, W.J., Danise, S., and Twitchett, R.J. 2017. A silicified Early Triassic marine assemblage from Svalbard. *Journal of Systematic Palaeontology* 15: 851–877.

Friedberg, W. 1921. Les brachiopods miocènes de la Podolie occidentale. *Prace Naukowe Uniwersytetu Poznańskiego, Sekcja Matematyczno−Przyrodnicza* 2: 1–20.

Gardner, J.A. 1928. The molluscan fauna of the Alum Bluff Group of Florida, Part I, Prionodesmacea and Anomalodesmacea. *United States Geological Survey Professional Paper* 142-A: 1–79.

Gobbett, D.J. 1963. Carboniferous and Permian brachiopods of Svalbard. *Norsk Polarinstitutt Skrifter* 127: 1–201.

Goldfuss, G.A. 1833. *Petrefacta Germaniae Tam Ea: Quae in Museo Universitatis Regiae Borussicae Fridericiae Wilhelmiae Rhenanae Servantur Quam Alia Quaecunque in Museis Hoeninghusiano Muensteriano Aliisque Extant, Iconibus et Descriptionibus Illustrata, Abbildungen und Beschreibungen der Petrefacten Deutschlands und der Angrenzenden Länder*. 164 pp. Arnz & Comp., Düsseldorf,

Gould, A.A. 1862. *Otia Conchologica: Descriptions of Shells and Mollusks, from 1839–1862*. 256 pp. Gould and Lincoln, Boston.

Gümbel, C.W. 1861. *Geognostische Beschreibung des bayerischen Alpengebirges und seines Vorlandes*. 948 pp. Justus Perthes, Gotha.

Hatai, K. 1940. The Cenozoic Brachiopoda of Japan. *Science Reports of the Tohoku Imperial University. 2nd Series, Geology* 20: 1–424.

Hatai, K. and Hayasaka, S. 1965. Two fossil species of *Discinisca* (Brachiopoda) from North Honshu, Japan. *Transactions and Proceedings of the Paleontological Society of Japan. New Series* 1960: 172–177.

Hölflinger, J. 2020*. Die Brachiopoden des deutschen Lias: Bestimmungstipps für Sammler*. 206 pp. Books on Demand GmbH, Österreich.

Holmer, L.E. and Popov, L.E. 2000. Lingulata. *In* R.L. Kaesler (ed.), *Treatise on Invertebrate Paleontology, Part H: Brachiopoda Revised Volume 1*, 30–146. Geological Society of America and University of Kansas, Boulder and Lawrence.

King, W. 1868. On some palliobranchiate shells from the Irish Atlantic. *Proceedings of the Natural History Society of Dublin* 5: 170–173.

Kittl, E. 1904. Geologie der Umgebung von Sarajevo. *Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt* 53: 511–746.

Kroh, A. 2003. The Brachiopoda of the Langhian (Lower Badenian) of the Molasse Zone and the northern Vienna Basin (Austria). *Annals of the Natural History Museum in Vienna* 104A: 145–153.

Lee, D.E. 1987. Cenozoic and recent inarticulate brachiopods of New Zealand: *Discinisca*, *Pelagodiscus* and *Neocrania*. *Journal of the Royal Society of New Zealand* 17: 49–72.

Mergl, M. 2010. Discinid brachiopod life assemblages: Fossil and extant. *Bulletin of Geosciences* 85: 27–38.

de Morgan, J. 1915. Note sur les mollusques brachiopodes des faluns de la Touraine. *Bulletin de la Société Geologique de France*, 4, 15: 260–273.

Muir-Wood, H.M. 1929. A new brachiopod *Discinisca ferroviæ* from the Woolwich beds. *Proceedings of the Geologists' Association* 39: 463–470.

Muir-Wood, H.M. 1936. Brachiopoda from the Lower Lias, Green Ammonite Beds, of Dorset. *Quarterly Journal of the Geological Society of London* 92: 472–487.

Muir-Wood, H.M. 1939. Four species of *Discinisca* (Brachiopoda) from the Eocene of the Hampshire Basin. *Proceedings of the Geologists' Association* 50: 149–158.

d'Orbigny, A. 1846. Molusques. *In* M. Ramón de la Sagra (ed.), *Histoire, Physique, Politique et Naturelle de l'ile de Cuba*, 2: 5–28. A. Bertrand, Paris.

d'Orbigny, A. 1849. *Prodrome de Paléontologie stratigraphique universelle des animaux Mollusques et Rayonnés, Volume 1*. 394 pp. Victor Masson, Paris.

Pérez, D.E., Farroni, N.D., Mosquera, A.A., and Cuitiño, J.I. 2023. First discinid brachiopods (Brachiopoda: Lingulida) from the Cenozoic of Patagonia (Gaiman Formation, Lower Miocene, Argentina). *Ameghiniana* 60: 203–215.

Radwańska, U. and Radwański, A. 1984. A new species of inarticulate brachiopods, *Discinisca polonica* sp. n., from the Korytnica Basin (Middle Miocene: Holy Cross Mountains, Central Poland). *Acta Geologica Polonica* 34: 253–269.

Radwańska, U. and Radwański, A. 1989. A new species of inarticulate brachiopods, *Discinisca steiningeri* sp. nov., from the Oligocene (Egerian) of Plesching near Linz, Austria. *Annalen des Naturhistorischen Museums in Wien, Serie A* 90: 67–82.

Radwańska, U. and Radwański, A. 1994. The topmost Cretaceous discinoscan brachiopods, *Discinisca* (*Arquinisca* subgen. n.) *vistulae* sp. n., from the middle Vistula valley, central Poland. *Acta Geologica Polonica* 44: 251–260.

Radwańska, U. and Radwański, A. 2003. BOSQUET'S (1862) inarticulate brachiopods: *Discinisca elslooensis* sp. n. from the Elsloo Conglomerate. *Bulletin de l'Institut Royal des Sciences Naturelles de Belqique, Sciences de la Terre* 73: 185–194.

Radwański, A. and Summesberger, H. 2001. A new species of inarticulate brachiopods, *Discinisca zapfei* sp. n., from the Upper Triassic Zlambach Formation (Northern Calcareous Alps, Austria), and a discussion of other Triassic discinoscans. *Annalen des Naturhistorischen Museum in Wien* 102: 109–129.

Schlotheim, E.F.B. 1820. *Die Petrefactenkunde auf ilem fetzigen standpunkte durch die beschreibung: Seiner sammlung versteinerter und fossiler überreste des thier- und Pflanzenreichs*. 614 pp. Becker's chen Buchhandlung, Gotcha.

Schmidt, M. 1938. *Die Lebewelt unserer Trias: Nachtrag*. 143 pp. Hennecke, Öhringen.

Schumacher, C.F. 1817. *Essai d'un Nouveau Système des Habitations des Vers Testacés*. 288 pp. Schultz, Copenghagen.

Seilacher, A. 1982. Ammonite shells as habitats in the Posidonia Shales of Holzmaden-floats or benthic islands? *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte* 1982: 98–114.

Smirnova, T.N., Ushatinskaya, G.T., Zhegallo, E.A., and Panchenko, I.V. 2017. Shell microstructure of *Discinisca suborbicularis* sp. nov. (Brachiopoda, Lingulata) from the Upper Jurassic of Western Siberia. *Paleontological Journal* 51: 480–490.

Sowerby, G.B. 1822. Remarks on the genera *Orbicula* and *Crania* of Lamarck, with description of two species of each genus; and some Observations proving the Patella distorta of Montagu to be a species of *Crania*. *Transactions of the Linnean Society of London* 13: 465–472.

Sowerby, G.B. 1847. *Thesaurus Conchyliorum, or Monograph of Genera of Shells, Volume 1*. 438 pp. Sowerby, London.

Sowerby, J.D.C. 1829. *The Mineral Conchology of Great Britain*. 250 pp. Richard Taylor, London.

Stenzel, H.B. 1964. Stratigraphic and paleoecologic significance of a new Danian brachiopod species from Texas. *Geologische Rundschau* 54: 619–631.

Suess, E. 1854. Über die Brachiopoden der Kössener Schichten. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe* 10: 283–287.

Tate, R. 1867. On the fossiliferous development of the zone of *Ammonites angulatus*, Schloth., in Great Britain. *Quarterly Journal of the Geological Society* 23: 305–314.

Thomson, M.R.A. 1971. Inarticulate Brachiopoda from the Lower Cretaceous of south-eastern Alexander Island. *British Antarctic Survey Bulletin* 25: 85–94.

Tunnell, Jr.J.W. 1982. Distribution and habitat of *Discradisca antillarum* (d'Orbigny, 1846) (Brachiopoda: Inarticulata) in the western Gulf of Mexico. *Proceedings, South Texas Fauna: A Symposium Honoring Dr. A. H. Chaney*, 37–48.

Wagner, G. 1913. Beiträge zur Stratigraphie und Bildungsgeschichte des oberen Hauptmuschelkalks und der unteren Lettenkohle in Franken. *Geologische und Paläontologische Abhandlungen* 12: 275–452.

Williams, A., Cusack, M., and Buckman, J.O. 1998. Chemico–structural phylogeny of the discinoid brachiopod shell. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences* 353: 2005–2038.

Wood, S.V. 1872. Supplement to the Monograph of the Crag Mollusca, with Descriptions of Shells from the Upper Tertiaires of the East of England. *Palæontographical Society* 166–173.

Xu, G.R. and Liu, G.C. 1983. Brachiopods. *In* Z.Y. Yang, H.F. Yin, G.R. Xu, S.B. Wu, Y.L. He, G.C. Liu and J.R. Yin (eds.), *Triassic of the South Qilian Mountains*, 84–128. Geological Publishing House, Beijing.

Yabe, H. and Hatai, K. 1935. On some Brachiopoda from the "Ryukyu Limestone" of Kikai-zima and Okinawa-zima, Ryukyu Islands and south-western Formosa (Taiwan). *Japanese Journal of Geology and Geography* 12: 93–102.

Zhang, Y., Shi, G.R., He, W.H., Zhang, K.X., and Wu, H.T. 2014. A new Changhsingian (Late Permian) brachiopod fauna from the Zhongzhai section (South China), Part 2: Lingulida, Orthida, Orthotetida and Spiriferida. *Alcheringa* 38: 480–503.