

ARCULUS SYKESII (CHASTER, 1895) [BIVALVIA, LASAEIDAE]. REVISITED WITH LECTOTYPE SELECTION AND NEW NORTHERN RECORDS FROM THE VIKING BANK

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Abstract Lectotype designation is made for *Lepton sykesii* Chaster, 1895 from shells in the Chaster collection held by the National Museum of Wales. *Arculus sykesii* (Chaster, 1895) is re-described with particular attention to details of the hinge teeth and ligament. Previous confusions concerning orientation of the valves is resolved. Verified records indicate a distribution from the Western Mediterranean to the northern North Sea. Recently collected specimens from the Viking Bank are the most northerly records yet.

Key words Lectotype, scanning electron micrographs, bivalve hinge, distribution.

Arculus sykesii was described from shell sand in Guernsey by George W Chaster in 1895, under the generic name of *Lepton*. Ever since, probably due to its minute size of 1.2mm, it has been subject to uncertainty over its description and systematic position. Material collected recently from the Viking Bank (DMcK) sent to PGO for confirmation necessitated the examination of the hinge using scanning electron microscopy. This revealed detail not noted in previous descriptions, including the original, and prompted a review of the species. This was aided by the discovery and subsequent lectotype designation from material in the Chaster collection held in the National Museum of Wales.

Chaster (1895) described the hinge as having a cardinal tooth in each valve with anterior and posterior laterals in both valves but no distinction of the right or left valves was made. In the same year JT Marshall (1895) wrote that he could “not detect the extremely small cardinal mentioned by Mr Chaster” but not stating if this was for one or both valves. Chaster (1895b) riposted that the cardinal was quite apparent when viewed from the dorsal aspect. In 1909, in a footnote, Monterosato erected the genus *Arculus* for *Lepton sykesii* but based this on the description taken from Marshall (1895). Consequently, Monterosato noted that the sculpture was not visible to the naked eye and that the hinge was simple. Tebble (1966) followed the original description of Chaster stating that

there is a single cardinal and single anterior and posterior laterals in each valve. Once again, no distinction of right and left valves was made and the position of the ligament was given with some uncertainty. Phorson (1988) illustrated the shell in sketches made from camera lucida observations but he too could not distinguish right and left valves, nor did he describe the hinge in detail.

Oliver *et al.* (2016) followed Tebble’s (1966) description despite the photomicrographs indicating a more complex hinge. Here we describe the shell in detail using a wide range of specimens including the type series from Chaster’s collection.

The systematic position has also been debated, Chaster firstly placing it with *Lepton* but Marshall and Monterosato placing it in *Neolepton*. Tebble (1966) placed it in the Leptonidae but as a *Neolepton*. Keen (in Newell, 1969) retained *Arculus* as a distinct genus and placed it in the Neoleptonidae but within the superfamily Cyamioidea. MolluscaBase (2018) consider it a valid genus but have now placed it in the Lasaeidae within the Galeommatoidea and thus refuting any affinity with the Neoleptonidae.

Arculus sykesii is known from relatively few records, most of those from British waters are marked on the NBN Atlas see <https://species.nbnatlas.org/species/NHMSYS0021054746>. The type locality is “dredged off Guernsey” and it has been collected there again, most recently by Phorson (1988). It has been found on the west coast of Ireland, Strangford Lough, southwest coasts of England, Isle of Wight (Light & Killeen,

1990), southwest Wales, Mull, Ardnamurchan and Benbecula (Brokenshire in Fisher, 2018). Recorded here are the first records for the far north of the North Sea (DMcK).

It has been recorded from Brittany and Normandy by Keukelaar & Hoeksema (1991) and Geuze (1995); the Seine Seamount by Beck, Metzger & Freiwald. It was reported from the Mediterranean by Warén & Carrozza (1994) and Margelli *et al.* (2006), the former being the first to note the commensal association with the tanaid crustacean *Aapseudes* (now *Tuberapseudes echinatus* (Sars, 1882). A similar association was recorded from southwest Wales (Peter Garwood pers. comm.) but with *Aapseudopsis latreilleii* (Milne Edwards, 1828) (Oliver *et al.*, 2016)

RE-DESCRIPTION

Material examined

Type material 3 shells +3 valves. Guernsey. Coll. Chaster. Syntype series Chaster (1895a). Lectotype designated, 1 shell with co-joined valves NMW. 1910.29.1567. Paralectotype 1 – shell with co-joined valves NMW. 1910.29.21352. Paralectotype 2 – shell disarticulated and attached to SEM stub. NMW. 1910.29.2136. Paralectotype 3–5. 3 right valves NMW. 1910.29.2137.

Chaster collection **2 valves**, Mounts Bay, Cornwall, leg. Tregelles, Coll. Chaster, NMW 1910.29.1568. Cited in Tregelles (1896). | **1 valve**, Dogs Bay, Connemara, Co. Galway, Ireland, leg. Standen, Coll Chaster, NMW 1910.29.1565. Cited by Chaster (1895b). | **2 valves**, Kenmare River, Co. Cork Ireland, Coll Chaster NMW 1910.29.1564. | **4 valves** Killala Bay, Co. Mayo Ireland, leg. Miss Warren, Coll. Chaster, NMW 1910.29.1566. | **1 shell +2 valves**, Guernsey, leg Chaster (his label), Coll Marshall, NMW 1953.183.778.

Marshall Collection **1 shell +2 valves**, Guernsey, 20 fathoms, leg Marshall, Coll Marshall, NMW 1953.183.779. Cited by Marshall (1897).

Garwood Collection 2 shells +8 specimens in 70% alcohol, Milford Haven, leg P. Garwood, NMWZ 2009.036.02538. Cited by Oliver *et al.* (2016).

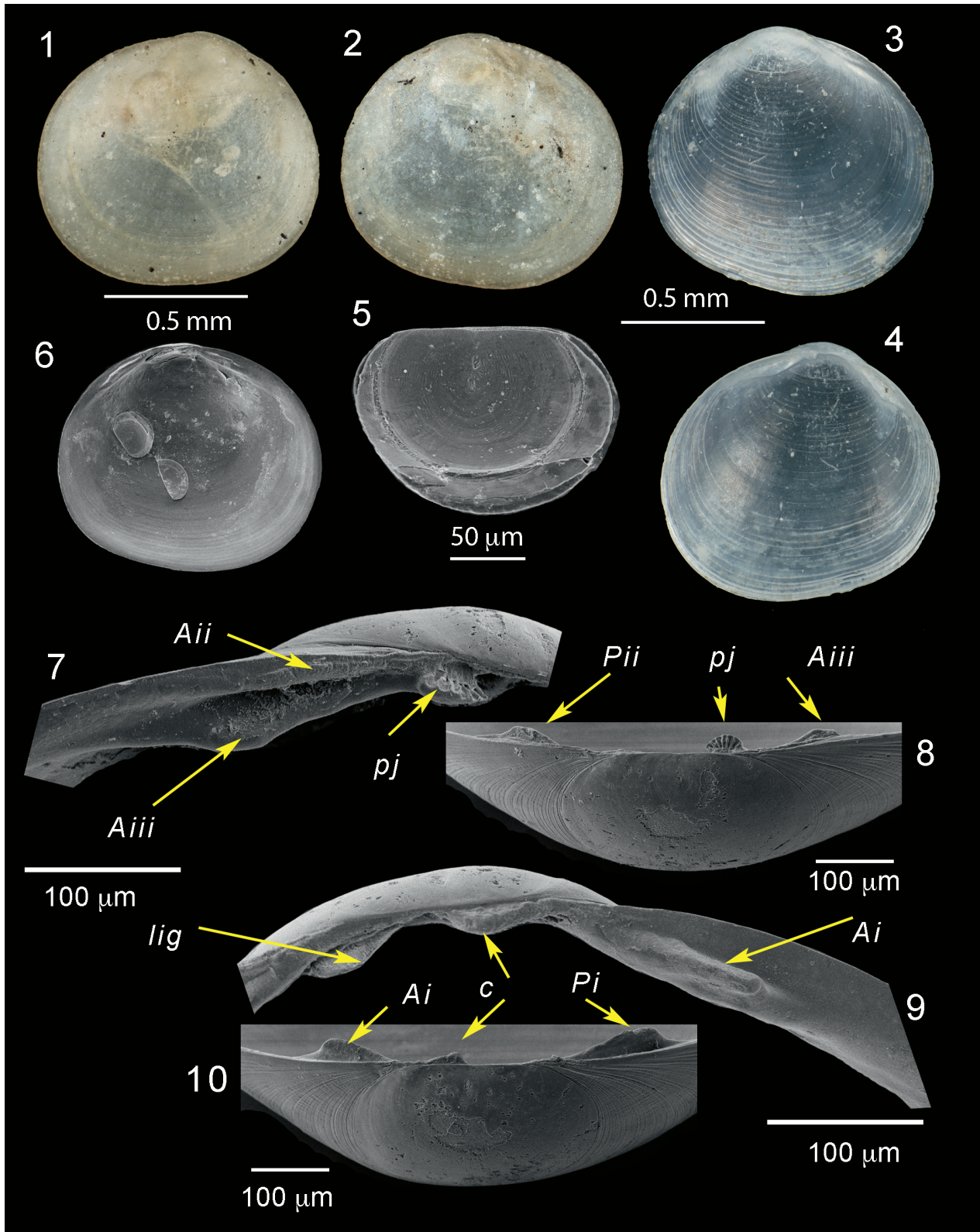
Phorson Collection **1 shell** +11 valves, Calgary Bay, Isle of Mull, Scotland, U.K., grid NM

317514, Stn BB1, 03/05/1995, leg T. Phorson, Coll T. Phorson, NMW.Z.2006.020.00095. | **1 valve**, Dog's Bay, near Roundstone, Connemara, Co. Galway, Ireland, grid L 609305, 53°22.5'N 9°57.5'W, Stn BB3, 10/06/1995, leg W. H. Pocock, Coll T. Phorson, NMW.Z.2006.020.00162. | **1 valve**, Sanna Bay, Ardnamurchan, Lochaber, Highland, Scotland, U.K., grid NM 443686, 56°44.5'N 06°11'W, Stn BB18, 04/05/1995, leg T. Phorson, Coll T. Phorson, NMW.Z.2006.020.00370. | **1 shell** +8 valve, Calgary Bay, Isle of Mull, Scotland, U.K., grid NM 317514, Stn BB19, 09/06/1997, leg T. Phorson, Coll T. Phorson, NMW.Z.2006.020.00383. | **2 shells** +4 valves, Calgary Bay, Isle of Mull, Scotland, U.K., grid NM 317514, 56°35'N 06°17'W, stn DD6, 28/06/1999, leg T. Phorson, Coll T. Phorson, NMW.Z.2006.020.00494. | **1 valve**, San Sebastián, Basque Country, Spain, 43°19'N 01°59'W, stn EE6, 05/04/2001, leg Félix Azpilicueta, Coll T. Phorson, NMW.Z.2006.020.00702. | **4 valves**, Vazon Bay (Western half), Castel, Guernsey, Channels Islands, U.K., 49°27'50.1"N 2°37'21.1"W, stn S1, 03–11/06/1987, leg T. Phorson, Coll T. Phorson, NMW.Z.2006.020.00709. | **1 valve**, Ventry Bay, West of Dingle, Co. Kerry, Ireland, grid V 037098, stn GG7, 15/06/1995, leg Bill Pocock, Coll T. Phorson, NMW.Z.2006.020.00731.

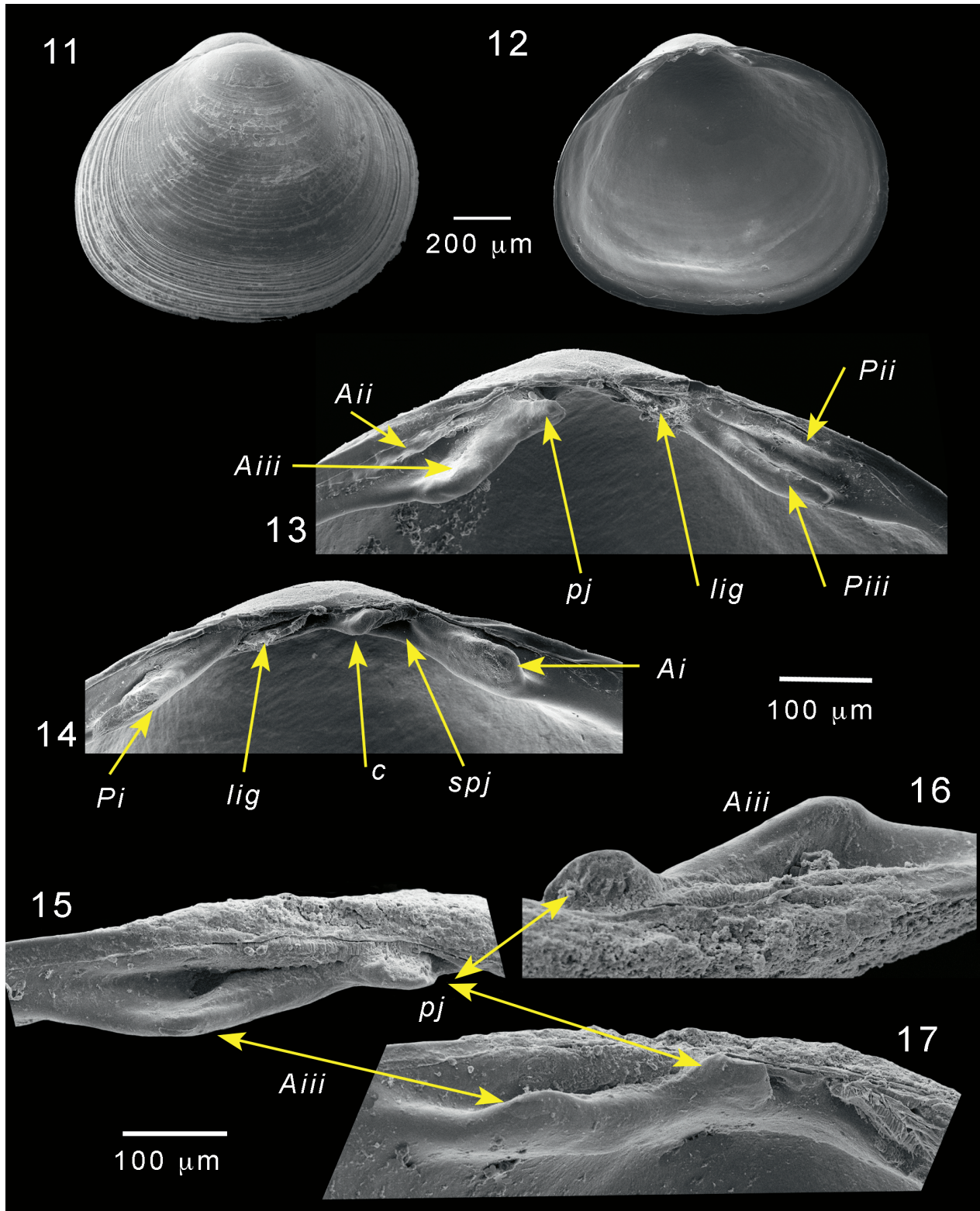
New Records **2 specimens** Viking Bank, North Sea, 60°31'N 01°37'E, 120m, 26/05/2018, leg. D. McKay, NMWZ 2018.011.001. | **2 specimens** Viking Bank, North Sea, 60°31'N 01°37'E, 120m, 26/05/2018, Coll. D. McKay. | **4 specimens** Viking Bank, North Sea, 60°32'N 02°06'E, 119m, 31/05/2018, Coll. D. McKay. | **1 specimen** Viking Bank, North Sea, 60°43'N 02°02'E, 119m, 28/05/2018, Coll. D. McKay. | **3 specimens** Viking Bank, North Sea, 60°31'N 01°32'E, 113m, 27/05/2018, Coll. D. McKay.

Shell To 1.2mm in length (lectotype 0.98mm). Thin, fragile. Equivalve. Relatively compressed. Outline almost equilateral, beaks very slightly in front of midline; subcircular, ventral margin becoming less curved then appearing somewhat rhomboidal. Beaks flat, early shell usually visible, discoloured in some. External sculpture of incised commarginal lines increasing in visibility with growth, overall with dense radial microscopic incisions.

Hinge weak. Ligament internal, in a short, narrow resilifer extending posteriorly under the beaks



Figures 1–10 Shells from the type series of *Lepton sykesii* (Chaster, 1895). **Figs 1, 2** external views of the right and left valves of the lectotype, NMW. 1910.29.1567. **Figs 3, 4** paralectotypes, external and internal views of cleaned left valve. **Figs 5–10** scanning electron micrographs of paralectotype. **Fig. 5** internal of complete right valve with remains of larval shells attached. **Fig. 6** a larval shell. **Fig. 7** anterior of hinge of right valve. **Fig. 8**, hinge of right valve viewed from a dorsal position. **Fig. 9**, anterior of hinge of left valve. **Fig. 10**, hinge of left valve viewed from a dorsal position.



Figures 11–17 Scanning electron micrographs of the shell and hinge of *Arculus sykesii*. **Figs 11, 12**, external and internal views of a shell from Viking Bank. **Figs 13, 14**, hinges of right and left valves respectively of a shell from Viking Bank. **Figs 15–17**, the lower lateral of the right valve viewed from different aspects of a shell from Milford Haven, **Fig. 15** – face view, **Fig. 16** – dorsal view, **Fig. 17** – ventral view.

Ai anterior lateral of left valve, *Aii* (upper) and *Aiii* (lower) laterals of right valve, *c* cardinal tooth, *lig* ligament, *Pi* posterior lateral of right valve, *Pii* (upper) and *Piii* (lower) laterals of right valve, *pj* projection of *Aiii*, *spj* socket formed by *c* and *Ai*.

(Figs 9, 13, 14). Left valve dentition (Figs 9, 10, 14); a minute cardinal peg anterior to ligament (*c*); single anterior (*Ai*) and posterior laterals (*Pi*); cardinal peg and dorsal apex of anterior lateral forming a small triangular socket (*spj*). Right valve dentition (Figs 7, 8, 13, 15–17); cardinal dentition absent, paired anterior (*Aii*, *Aiii*) and posterior laterals (*Pii*, *Piii*); inner anterior lateral large (*Aiii*), outer thin, indistinct; dorsal extremity of inner anterior lateral projecting from under beak (*pj*), appearing like a cardinal peg and forming a socket under the beak anterior to the ligament; dorsal surface of anterior lateral projection grooved: posterior laterals forming a distinct socket between them.

Inner margin of shell smooth. Pallial muscle scars indistinct.

On adult shell prodissoconchs 1 and 2 not distinguishable, larval shell appearing smooth and 340µm in diameter. Intact larval shell remaining on inside of paralectotype consists of both P1 and P2, P1 136µm in diameter, P2 180µm in diameter, so probably not fully developed.

Anatomy (Fig. 18) Note: only a brief description can be given here as gross dissection of such a

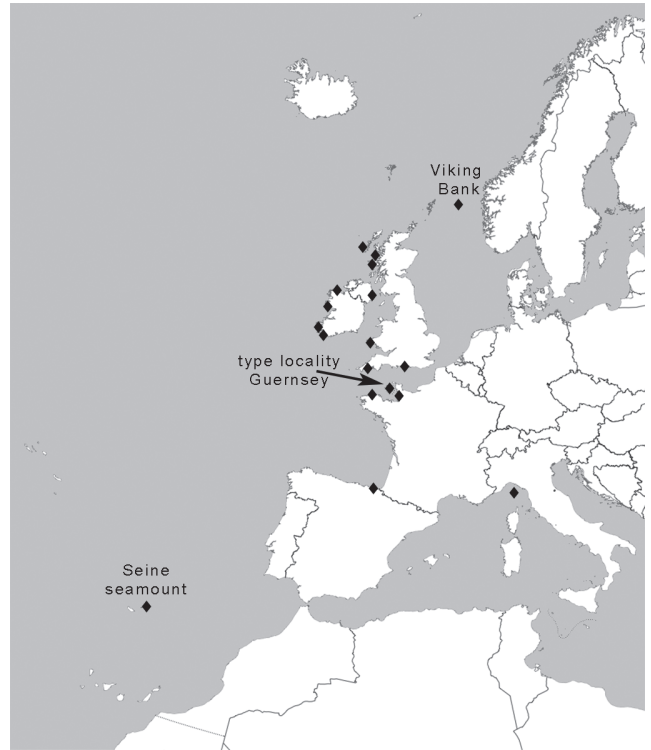


Figure 19 Distribution map for *Arculus sykesii* based on verified records.

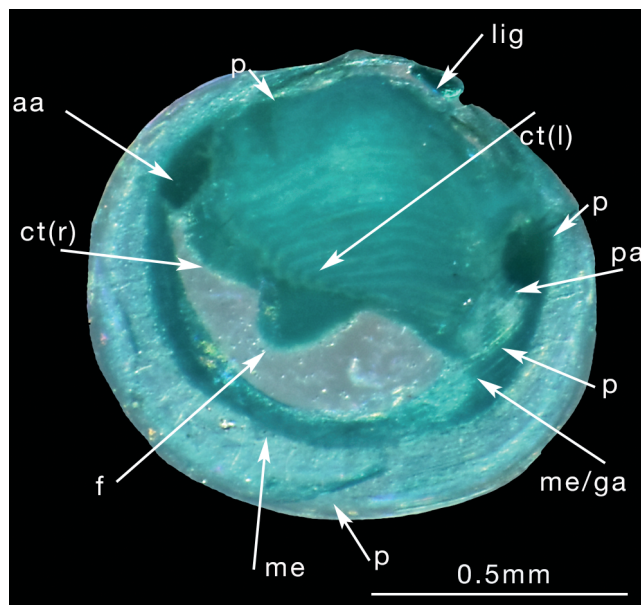


Figure 18 Gross anatomy from the left side after removal of shell and partial removal of periostracum, stained in methylene-blue. Milford Haven, leg P. Garwood, NMWZ 2009.036.02538.

aa anterior adductor muscle, **ct(l)** ctenidium of left side, **f** foot, **lig** ligament, **me** mantle edge, **me/ga** point of attachment of gill axis to mantle edge, **p** remnants of periostracum, **pa** posterior adductor muscle.

small specimen has not been possible. The shell was dissolved with 5% hydrochloric acid and tissues stained in methylene blue.

Mantle edge thick, unfused with posterior attachment to gill axis. Ctenidium a single demi-branch, filament not reflected, approximately 10 in number. Adductor muscles equal in size, circular. Foot small pointing to the anterior.

Life history The presence of larval shells inside that of an adult is indicative of a brooding life cycle where the eggs are incubated to relatively large larval size, in this case to almost one third of the adult.

Distribution From the western Mediterranean and the North-East Atlantic from the Seine Seamount at 33 45'N to the Viking Bank at 60 31'N. A revised distribution map is presented using all known and verified records (Fig. 19).

DISCUSSION

The SEM micrography resolves previous discrepancies in the dentition, confirming that there is a cardinal peg in the right valve but in the left valve the apparent cardinal is a projection of the

anterior lateral tooth. When viewed from the dorsal aspect, this projection appears quite distinct from the lateral (Fig. 16) but viewed face on (Fig. 15) and more so when viewed ventrally (Fig. 17) this projection appears continuous with the lateral. There are no lines indicating that the structure has been formed by fusion of two teeth. The radial grooves on the dorsal surface of the projection are present in all specimens examined so far and these correspond with striations on the under surface of the opposing socket. It is assumed that these structures help to strengthen the articulation of the valves although the much larger lateral teeth would appear much more appropriate for this function. The presence of an internal ligament is also confirmed and its orientation gives the indication of right and left valves. In all other galeommatoidea where there is an internal resilifer it is either amphidetic or opisthodontic, the latter condition here suggesting that the resilifer is angled to the posterior of the shell. This orientation is confirmed from the anatomy where the ligament can be seen to lie towards the posterior.

The hinge structure shown here is confirmed to be unlike that of any Neoleptonidae as described by Salas & Gofas (1988) and the placement in the Galeommatoidea is considered most appropriate. The placement within any family or subfamily remains uncertain as does the systematics of this superfamily as a whole.

The commensal association with tanaid crustaceans has been observed but from the examination of the type material at hand it appears that some of the specimens were collected alive, as evidenced by dried tissue remains. While most records are of dead shells from shore drift Marshall (1895) does record collecting a living specimen from Guernsey. The exact nature of the association is therefore unclear, if free living are they found with but not attached to tanaids? To date *Arculus* has been found attached to two different species of tanaid but neither of these have ranges that coincides with the full range of *Arculus*. Both *T. echinatus* and *A. latreilleii* are southern species suggesting that *Arculus* in the Outer Hebrides and on Viking Bank must be associated with different tanaids.

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