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AN ANNOTATED KEY TO THE BRITISH SPECIES OF CARDIIDAE

by

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This key first appeared in The Conchological Newsletter No. 10 (Sept. 1964). Since then much more research has been done on the 'Cardium' edule/glaucum complex (Boyden 1971b; Boyden & Russell, 1972; Russell, 1971) and also on the lagoon form of 'Cardium' exiguum (Petersen & Russell, 1971). Attention has been drawn to the variability of rib number in these species, particularly in still-water examples: indeed, so variable is this character in C.edule and C.glaucum, that Russell (1972) suggests that "it may be controlled to a large extent by the environment, and thus should not be used as a taxonomic characteristic." Dr. Shelagh M Smith (in litt. 9.5.1977) observes that there is a marked difference between the 'Cardium' scabrum collected in Northern and Southern Britain, and that the presence or absence of 'pits' between the ribs, the number of ribs, the fluting on the inside of the shell, as well as the type of tubercles or scales, are all unreliable as factors on which to base a key*. The difficulties of identifying species of cockles, which show immense variation within the framework of strong family likeness, are voiced by Jeffreys (1863:265) who writes that "The cockles are easily characterised and cannot be well confounded with any other family", unlike the families with which he has previously dealt, that tax "the discriminative power of the systematist to an extent which makes conchological nature almost faint under the task." Later (p.290) he emphasises the variability of C.edule, no two individuals of which, he says, can be confused.

As C.edule is the only species which is abundant and widely distributed in Britain, it is suggested that students acquire a collection of unworn valves, especially juvenile ones, which can be used for comparison with Parvicardium species. Even young C.edule and C.glaucum can be distinguished from the several species of Parvicardium by the presence of two posterior lateral teeth in the right valve - a feature used by Tebble (1966, 1976) and now incorporated in this revised key.

The nomenclature too has been revised in recent years. Bowden and Heppell (1968), Tebble (1966) and Nordsieck (1969) are in general agreement with Moore (1969), a work based on the study of fossil and recent genera of the world. This last authority is followed in the nomenclature used in the present key, but a summary of the various usages is appended after the well-known names listed by Winckworth (1932). There are at present some 200 species of the family Cardiidae in the world, and these are arranged in five subfamilies, 23 genera and numerous subgenera (Moore, 1969). British genera are Acanthocardia, Parvicardium and Plagicardium in the Cardiinae, and Laevicardium and Cerastoderma in the Laevicardiinae.

* see addendum

British species listed by Winckworth (1932), compared with nomenclature in Tebble (1966 - as T); Bowden & Heppell (1968 - as B & H); Nordsieck (1969 - as N); and Moore (1969 - as M).

Cardium L., 1758.	C.costatum L. (from W.Africa) is the type of Cardium s.s., and this genus is used for closely related species, none of which are British.
S.g. Acanthocardia Gray, 1851.	Generic status (T; B & H; N; M)
aculeatum L., 1758	Type of Acanthocardia s.s. (Not echinatum as in Winckworth) A.aculeata (T; B & H; N; M)
echinatum L., 1758.	A.echinata (T; B & H; N; M)
tuberculatum L., 1758.	Type of Rudicardium Coen, 1915. Acanthocardia tuberculata (T) A. (Rudicardium) tuberculata (B & H; M) Rudicardium tuberculatum tuberculatum (N)
S.g. Parvicardium. Monterosato, 1884.	Generic status (T; N; M) Subgen. of Carastoderma (B & H). N.B. The definition of Parvicardium in Moore (1969) includes small size, and sculpturing of heavy cross-threads or spines on the ribs, so it is assumed that minimum, ovale, scabrum and exiguum would all be classified by Moore in Parvicardium.
minimum Philippi, 1836.	subsp. suediense Reeve, 1845. Parvicardium minimum (T) P. minimum suecicum Loven. (N) Cerastoderma (Parvicardium) minimum (B & H)
papillosum Poli, 1795.	Type of Papillicardium Sacco, 1899. Parvicardium papillosum (T) Plagiocardium (Papillicardium) papillosum (B & H) Papillicardium papillosum (N)
ovale Sowerby, 1840.	Parvicardium ovale (T; N) Cerastoderma (Parvicardium) ovale (B & H)
scabrum Philippi.	Parvicardium scabrum (T; N) Cerastoderma (Parvicardium) scabrum (B & H)
exiguum Gmelin, 1791	Parvicardium exiguum (T) Cerastoderma (Parvicardium) exiguum (B & H) Parvicardium exiguum exiguum (N) (Baltic specimens are now recognised as a separate species hauniense (Petersen & Russell, 1971)

S.g. Cerastoderma Poli, 1795. edule edule L.1758	Generic status (T; B & H; N; M) Type of Cerastoderma. Cerastoderma edule edule L., 1758. (T; B & H; M)
edule lamarcki Reeve, 1845	Cerastoderma lamarcki (T) C. glaucum (Poiret, 1789) (B & H) C. glaucum (Brugiere, 1789) (N) Correctly ascribed to Poiret; see B & H, and Boyden (1971)
edule beltica Reeve, 1845.	Synonym of 'edule lamarcki'.
S.g. Laevicardium Swainson, 1840. crassum Gmelin, 1791.	Generic status (T; B & H; N; M) Laevicardium crassum (T; B & H; N)

KEYS TO THE SHELLS OF BRITISH SPECIES.

Note: Cockles vary greatly in shape within a species, and there is some variation of shape between juvenile and mature stages, the latter usually becoming produced posteriorly with age.

Processes on ribs are generally more obvious and pointed on the posterior (Parvicardium exiguum is an exception), flattened on the anterior, and tend to become squamose on ventral margins of the maturing shell. They may become worn even in the living state, making determination more difficult, and when dead and beach-rolled they may be impossible to name accurately. The proportion of rib width to furrow width, of which use is made in the diagrams, is a useful guide to identification in all stages of growth.

KEY 1

Key 1 is designed to distinguish 'mature' specimens only, i.e. ones within the given size range.

1 Ribs faint, 40-42 in number, with no processes: inside margin fluted in middle and towards sides. L.50-75 mm. (Gravel, sand, etc.; off-shore: all round coast).....Laevicardium crassum (Gmelin)

\- Ribs obvious.....2

2 More than 25 mm. long 3

\- Less than 25 mm. long 7

3 Ribs traversed by scales and right valve with two posterior lateral teeth 4

\- Ribs with spines or tubercles and right valve with one posterior lateral tooth 5

4 Scales on shell-centre well-spaced and straight: posterior ribs well developed: ligament long and conspicuous: ribs 20-28: inside fluted only towards margins. (Clean and muddy sand pebbles and muddy gravel: mid-tide to shallow water: all round coasts)....Cerastoderma edule (L.)

\- Scales on shell-centre close-set and rather flexuous: posterior ribs scarcely developed: ligament short and not conspicuous: ribs 18-32, the posterior ones being obscured: inside usually fluted throughout. L.25-50 mm (Usually in estuaries, brackish lakes or ditches: very variable like C.edule: especially in S.E. England and S. and W.Ireland where lagoon habitats are more common).....Cerastoderma glaucum (Poiret)

5 Ribs created with tubercles which are not obviously joined at their bases although a low sunken keel may sometimes be present: ribs 21-11: coarse flexuous striations in broad furrows between the ribs: shell very heavy and with slight gloss: inside fluted throughout except in very heavy specimens: colour yellowish, often with darker concentric zones. L.50-75 mm (Muddy sand and gravel: from ELWS to a few fms: S.W. England, S.W. Ireland and Channel Isles.....Acanthocardia tuberculata (L)

\- Ribs created with spines which are very obviously joined at their bases by a fine raised keel 6

6 Fairly coarse flexuous striations between the ribs: ribs 18-22: shell medium weight and with no gloss: cardinal teeth in left valve approximately same size: inside fluted throughout: colour yellowish-white with reddish-brown or brown periostracum. L.50-75mm. (Sand to gravel: from ELWS to deep water: all round coasts.).....Acanthocardia echinata (L)

\- Fine rather even and usually straight striations between the ribs: ribs 20-22: shell very light in weight and glossy: posterior cardinal teeth in left valve smaller than anterior one: inside fluted throughout: colour yellowish with reddish tinges. L.75-100 mm. (Probably silts and sand: S.W. England and Channel Isles.).....Acanthocardia aculeata (L)

7 Less than 23 ribs, each with sharp off-centre keel usually crested with small tubercles, especially on anterior side: ribs 20-22: strong keel from umbones to posterior ventral margin: inside fluted only towards margins: yellowish-brown and usually with well-developed brown or greenish-grey periostracum. L.ca.12 mm. (On algae and in gravelly-sand to mud: tidal estuaries from ELWS to ca.30 fms., and lagoons: all round coasts.).....Parvicardium exiguum (Gmelin)

Note that the lagoon form may have more ribs, fewer rib processes, and a reduced keel.

\- More than 23 ribs 8

8 Processes absent from central ribs and rather sparse on others or absent from all ribs: 25-26 ribs, the posterior ones with short prickles, the anterior ones with curved transverse plates: inside fluted well beyond margins: yellowish-white and usually variegated posteriorly. L.7-12 mm. (Muddy sand and gravel: occasionally ELWS to 60 fms.: all round coasts) .....Parvicardium ovale (Sowerby)

\- Processes on all ribs.....9

9 Processes equally developed on posterior and anterior ribs: 28-32 ribs covered with very closely-placed minute arches scales, sometimes in double rows: inside fluted throughout: always milk-white. L.6-9 mm. (Mud to gravel: 5 fms to deep water: widely distributed but very local..... Parvicardium minimum (Philippi)

\- Processes more developed on posterior of shell.....10

10 Ribs with close-set rounded, crisp-like scales: 24-28 ribs: inside fluted only near margins: usually milk-white. L.10-12 mm. (Muddy sand, gravel, shell-gravel and stone: ELWS to deep water: widely distributed but local.).....Parvicardium scabrum (Philippi)

\- Ribs with conical tubercles: 24-27 ribs: inside fluted beyond margins: yellowish. L.12 mm. (Gravelly sand: 15-20 fms.: It has not been found living north of the Channel Isles although empty shells have been found on the coast of Cornwall and the Isles of Scilly..... .....Plagiocardium papillosum (Poli)

KEY 2

Key 2 is designed to distinguish juvenile specimens of Acanthocardia, Laevicardium and Cerastoderma from Parvicardium: and Acanthocardia spp. from one another.

1 Ribs faint: 40-42, with no processes.....Laevicardium crassum

\- Ribs obvious 2

2 Right valve with two posterior lateral teeth .....Cerastoderma spp.

\- Right valve with one posterior tooth 3

3 Ribs not more than 22 4

\- Ribs more than 22 (including usual lagoon form of P.exiguum)...Parvicardium spp.

4 Shell rounded .....Acanthocardia spp.

(A.tuberculata has its distinctive tubercles, not joined by a keel. A. echinata and A.aculeata are more difficult to distinguish whilst under 20 mm. across, but if the protoconch is examined under good light and magnification, a reliable character seems to be the ribs being wider than the intercostal grooves in A.aculeata, and narrower than the grooves in A.echinata, with striations wider apart in the former species.)

\- Shell with keel from umbones to posterior ventral margin..Parvicardium exiguim

DISTINGUISHING FEATURES OF C.EDULE AND C.GLAUCUM

Petersen (1958) separates the two species principally by the length of ligament which is shorter in C.glaucum than in C.edule. Taking the X-axis as the greatest breadth of the shell (i.e. across the beaks, or umbones) and the Y-axis as the length of the ligament, the two species plotted on a graph may be separated by the line $X = 3.5Y + 2$; e.g. C.edule ca.10 mm. broad will have a ligament 2.5 - 3mm., whereas a specimen of C.glaucum of the same breadth will have a ligament only 1-2 mm. long. Petersen adds the following characters as a more variable guide:-

	C. edule		C.glaucum
1.	Ribs in middle part of shell flat and provided with small scales some distance from one another.	1a.	Ribs in middle part of shell sharp and with small triangular closely-placed scales, formed from the periostracum.
2.	Ribs on posterior of shell fairly well-developed and therefore a wavy line around the siphon area.	2a.	Ribs on posterior of shell scarcely developed and therefore almost straight lines around the siphon area.
3.	Periostracum little developed.	3a.	Periostracum thick and covering 75% of the shell.
4.	Colour usually whitish, and shape more circular.	4a.	Usually with livid bands or areas, and shape produced posteriorly.
	N.B. Colour and shape are not considered reliable taxonomic characters by Petersen.		
5.	Never found climbing in vegetation.	5a.	Often climbing in vegetation and using byssus.
6.	Not tolerant of salinity below 20 parts per mille.	6a.	Tolerates salinity from 25 to ca. 5 parts per mille.

The material on which Petersen's work was based came from localities where the two species intermingled on the same substrate at the mouths of two estuaries on the Kattegat coast of Jutland. Commonly, C.glaucum is much lighter in weight than C.edule.

ADDENDUM

In the preparation of the keys many helpful suggestions from Dr Shelagh Smith were incorporated and these are gratefully acknowledged. Dr Smith has added the following note.

There are considerable differences between examples of the same species not only over the range covered but also within populations. Previous keys and differential diagnoses essentially based on single characters such as the number of ribs, fluting on the inside of the shell, presence or absence of pits between the ribs and even the type of tubercles or scales, have been found wanting, especially when specimens from Scottish and Irish waters are taken into consideration. Particular attention is drawn to the fact that all species of Parvicardium may have pits between the ribs, northern forms being seldom unpitted. Parvicardium spp have a variability of rib number outside that indicated in this key, the rib number is merely a useful guide in conjunction with the other characters. Especial care should be taken with Acanthocardia echinata. Examples of this species which do not fall within the parameters of this key have been found in northern waters, e.g. specimens taken from clean sand (Firth of Forth, ELWST: Faroe, 110m) are glossy, and some specimens from various substrates (Moray Firth, 55m; Faroe, 165m) do not have obvious keels joining the spines. It is likely that Acanthocardia echinata normally exhibits considerable variation outside the range of its congeners. Users of this key should not automatically exclude glossy or keel-less Acanthocardia from this species.

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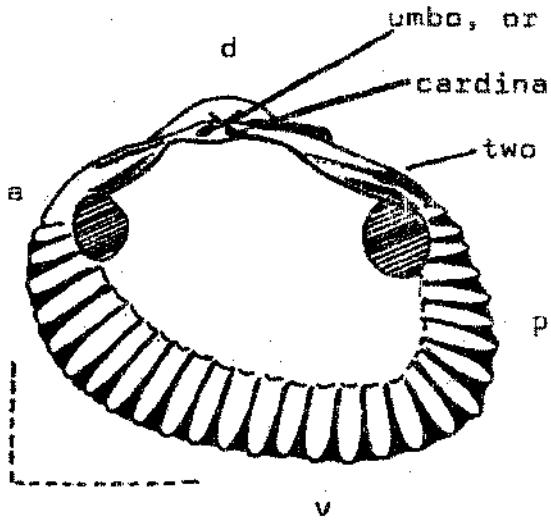
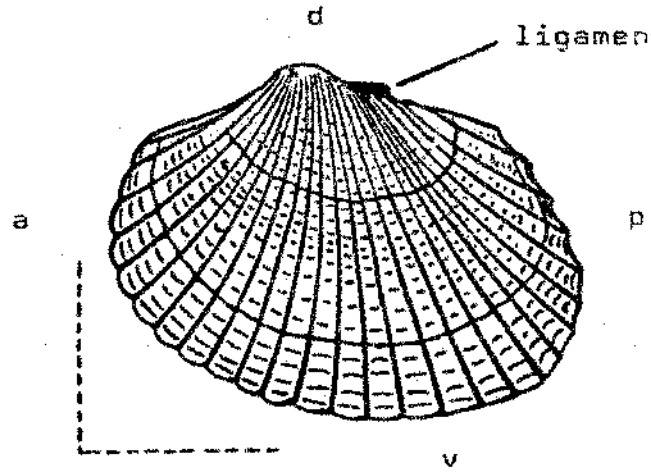
SHELL FEATURES OF THE CARDIIDAE

C. edule (42 x 35 mm.)



interior view of right valve

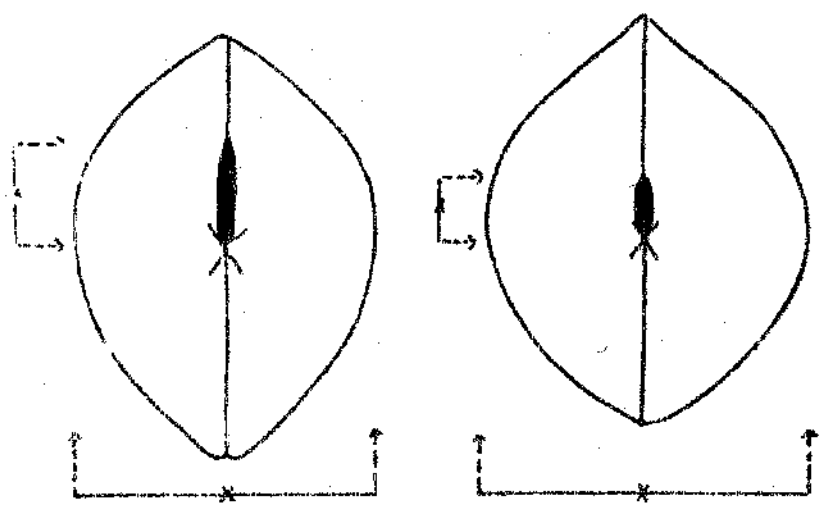


ribs with very narrow separating furrows

exterior view of left valve

C. edule, juvenile (25 x 24 mm.)
showing round shape

a = anterior p = posterior d = dorsal v = ventral



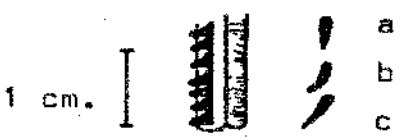
C. lamarcki C. edule

after Peterson (1958)

Diagrams of portions of ribs from ventral margins of shell centre, showing width of furrows relative to ribs, and processes in certain Cardiidae. a, b and c represent typical processes from anterior, middle and posterior of shell respectively.

Size of specimens used for diagrams is given in brackets.

A. aculeata (75 x 70 mm.)



A. echinata (55 x 50 mm.)

A. tuberculata (70 x 65 mm.)

P. minimum (5 x 5 mm.)

P. papillosum (12 x 12 mm.)

P. ovale (10 x 9 mm.)

P. scabrum (12 x 10 mm.)

P. exiguum (12 x 10 mm.)