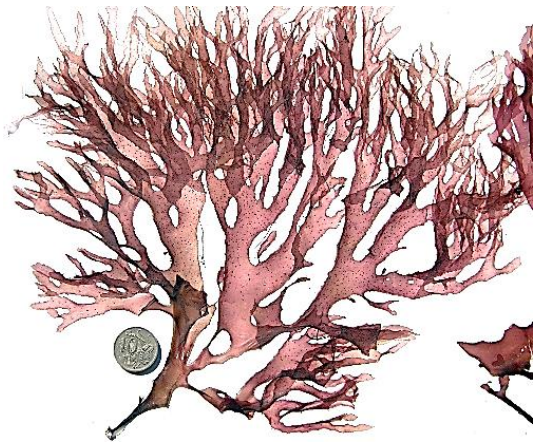
BROAD BLADED RED ALGAE

Red Algae.	Classification is based on detailed reproductive features. Many species unrelated reproductively have similar vegetative form or shape, making identification very difficult if the technical systematic literature is used.
This key	Fortunately, we can use this apparent problem to advantage - common shapes or morphologies will allow you to sort ***some*** algae directly into the level of genus or Family and so shortcut a systematic search through intricate and often unavailable reproductive features. The pictured key below uses this ***artificial*** way of starting the search for a name. It's designed to get you to a possible major group in a hurry.
Scale:	the coin used as a scale is 24 mm or almost 1" wide. Microscope images of algae are usually blue stained.
Names	Common names are from Edgar, G. J. *Australian marine life: the plants and animals of temperate waters*. Sydney, Reed New Holland. Those marked with §are descriptive names of the author
Species names	come from Womersley, H.B.S. *The Marine Benthic Flora of southern Australia* as it continues to be the most comprehensive and accessible publication of Red algae. Recent name changes from the Website ***Algaebase*** have been added.

Excluded

- leafy algae with blades divided regularly into laterals. **Go to "Feathery/flat/fishbone-branched Red algae"**
- algae with slimy surfaces **Go to "Slimy Red algae"**
- ribbon-bladed algae – those with compressed narrow branches (5-15 mm broad) **Go to "Strap and ribbon-like red algae"**

Craspedocarpus ramentaceus ribbon-bladed alga **excluded from this key**



Gloiophyllis barkeriae – with flat axes, but highly divided and slimy- **excluded from this key**

Gelinaria ulvoidea – flat axes but regularly divided at their edges - **excluded from this key**

KEY

1a. blades tissue-paper thin, almost transparent, edges often ruffled, stalks small or practically absent ..... 2.

1b. blades thicker, leathery, gristly or parchment-like, opaque, edges smooth or wavy, usually attached by a stalk ..... 5.

2a. blades usually whole and undivided, 2 cells thick, cells similar throughout. Figs 1-4.
… †*Pyropia*, *Porphyra* (Laver, 3 spp)
go to "*Porphyra*"

2b. blades sometimes lobed, > 2 cells thick, of several cell types …… 3.

3a. surface views of young blades show rings (rosettes) of cells; cross sections and tissue squashes may show thin threads in addition to large round cells. Figs 5-7.
…….....……. *Leptosomia rosea*
go to "Rhodymeniaceae"

3b. rosettes ***absent***; tissue squashes show a few large, spidery, ***long-armed*** (ganglionic) cells and numerous smaller cells ..... 4.

4a. blade "shot-holed" or entire, smooth or with a spiny surface; evenly coloured. Figs 8-13 (next page).
…….....…. *Kallymenia* (5 spp)
go to "*Kallymenia*"

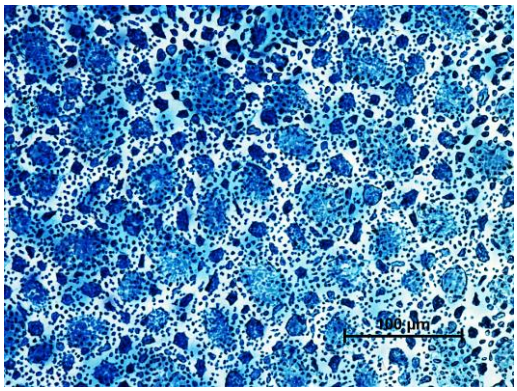
4b. blade whole, smooth, sometimes ***mottled***. Figs 14-17 (next page).
…..... *Halymenia* in part
go to "Halymeniaceae"

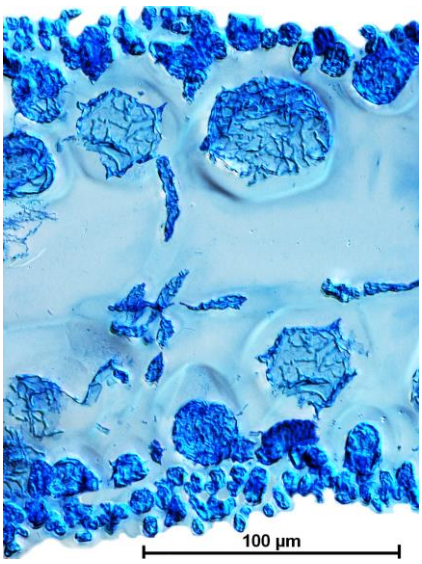
Figs 1, 2: †*Pyropia* (*Porphyra*) *columbina*
Left: narrow bladed form

Right: broad-bladed form

Fig. 3: †*Porphyra lucasii*, blades exposed at low tide

Fig. 4 (right): †*Porphyra* woolhousiae, blades on green algal





Figs 5-7: *Leptosomia rosea*
Left: plants on a stem of a sea grass
Centre: surface view, cell rosettes
Right: cross section, mix of large cells and threads in the core

†*Pyropia* has been proposed for *Porphyra columbina* on the basis of nuclear and plastid genes (see Sutherland, J.E. *et al* (2011). **A new look at an ancient Order: generic revision of the Bangiales (Rhodophyta)**. *Phycological Society of America* **47**, 1131–1151).
In their listing of species, *Porphyra lucasii*, was retained, probably because molecular analysis of this species was not attempted and *Ph. woolhouseae* was not mentioned. Southern Australian species are structurally very similar and the criteria used in ***the Marine Benthic Flora of southern Australia*** have been be used when constructing "*Porphyra* at a glance", a pictorial key to which you are referred in step 2a of the key above, as the only accessible way of separating species.

Fig. 8: *Kallymenia cribrosa* (Holey Red Lettuce). **(as *Leiomenia cribrosa* in *Algaebase*).** Holes small, about the same size across the blade

Fig. 9: *Kallymenia cribrogloea*, (Holey Red Lettuce). **(as *Austrokallymenia cribrogloea* in *Algaebase*).** Holes decreasing in size towards the blade margin

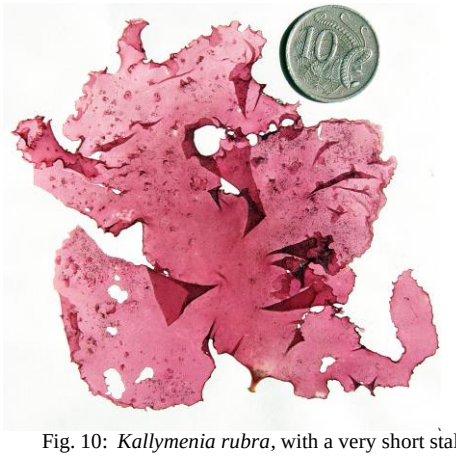


Fig. 10: *Kallymenia rubra*, with a very short stalk

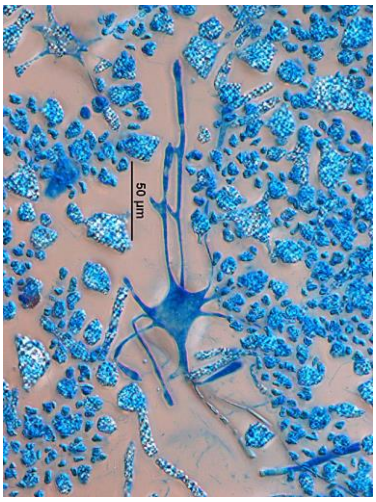


Fig. 11: *Kallymenia rubra*, tissue squash, long-armed (ganglionic) cell

Kallymenia spinosa Figs 12-13,
Above: plants with spiny surfaces
Right: tissue squash, long-armed (ganglionic) cells (arrowed), young female structures (carpogonial systems, ***c sys*)**

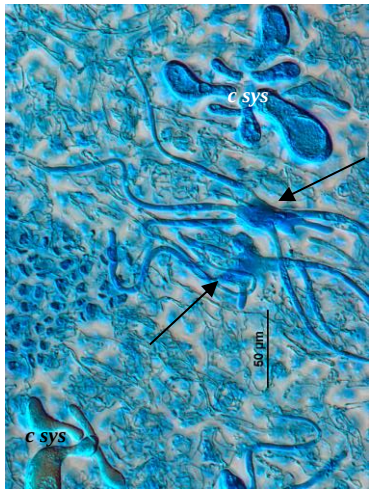
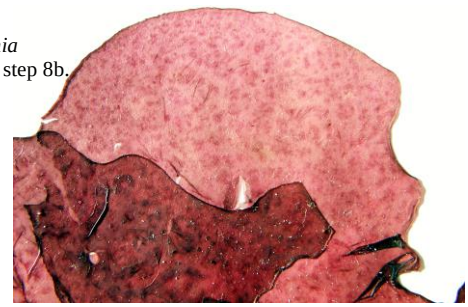


Fig. 14: *Halymenia kraftii*

can be confused with *Erythrymenia minuta*, see step 8b.



Figs 15-17: *Halymenia plana*,
Above: whole plant
Above, right: mottled surface
Below, right: tissue squash, long-armed cells prominent amongst small surface cells and thread-like inner cells

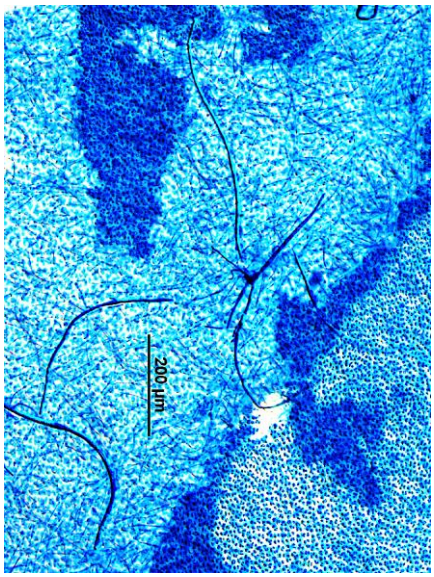


Fig. 17b: *Halymenia muelleri* mottled, thick blades

5a. surface felty with microscopic hairs; tissue squashes show only fine, twisted threads. Rare. Figs 18, 19. ..... *Predaea huismanii*
go to "Nemastomataceae"

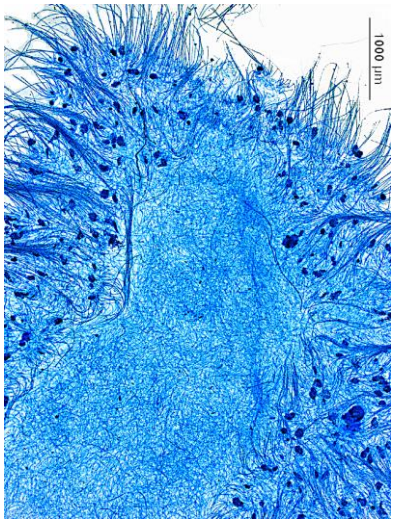
5a. surface ***not*** felty; cross sections or tissue squashes show either threads with chains of small cells ***or*** oval cells of different sizes ..... 6.

6a. cross sections show a core of large oval cells mixed with or grading to small ones in outer layers ..... 7.

6a. cross sections show a core of threads and outer layers with chains of small cells ..... 10.

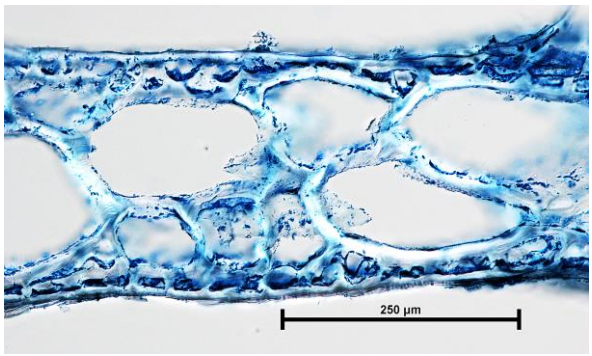
7b. tips of ***young*** blades notched and with a diamond cell-pattern in surface view; older blades often dark red-brown and lacking the surface diamond-shaped cell pattern but with numerous spots consisting of clumps of microscopic hairs (trichoblasts), some bearing reproductive structures. Figs 20-25. ..... *Lenormandia latifolia*
Family: Rhodomelaceae
Tribe: Amansieae

7b. blades not notched; diamond cell-pattern and hair clumps ***absent*** ..... 8.



Figs 18, 19: *Predaea huismanii*
Left: whole plant
Right: tissue squash

Figs 20-22: *Lenormandia latifolia*,
Left: young blade, diamond cell pattern, patches of hairs, notched tip
Above: older blade, diamond cell-pattern obliterated, basal stalk very short
Right: older blade, ruffled, torn into elongate lobes



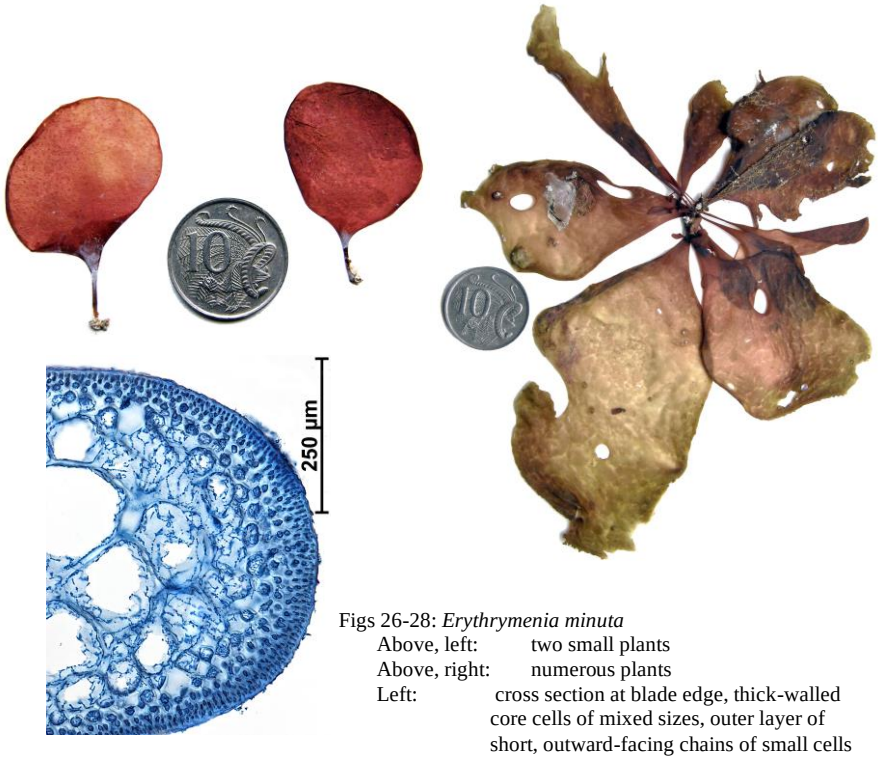
Figs 23-25: *Lenormandia latifolia*
Left: blade detail, patches of hairs, notched tip
Centre: patch of hairs (trichoblasts)
Right: cross section of blade, mix of large and small cells in the core (medulla), small cells in the outer layer (cortex)

8a. plants may be large (50-200 mm tall), blades frilly, or with marginal outgrowths; cross sections show 1-2 rows only of small cells in outer layers (cortex) ..... 9.

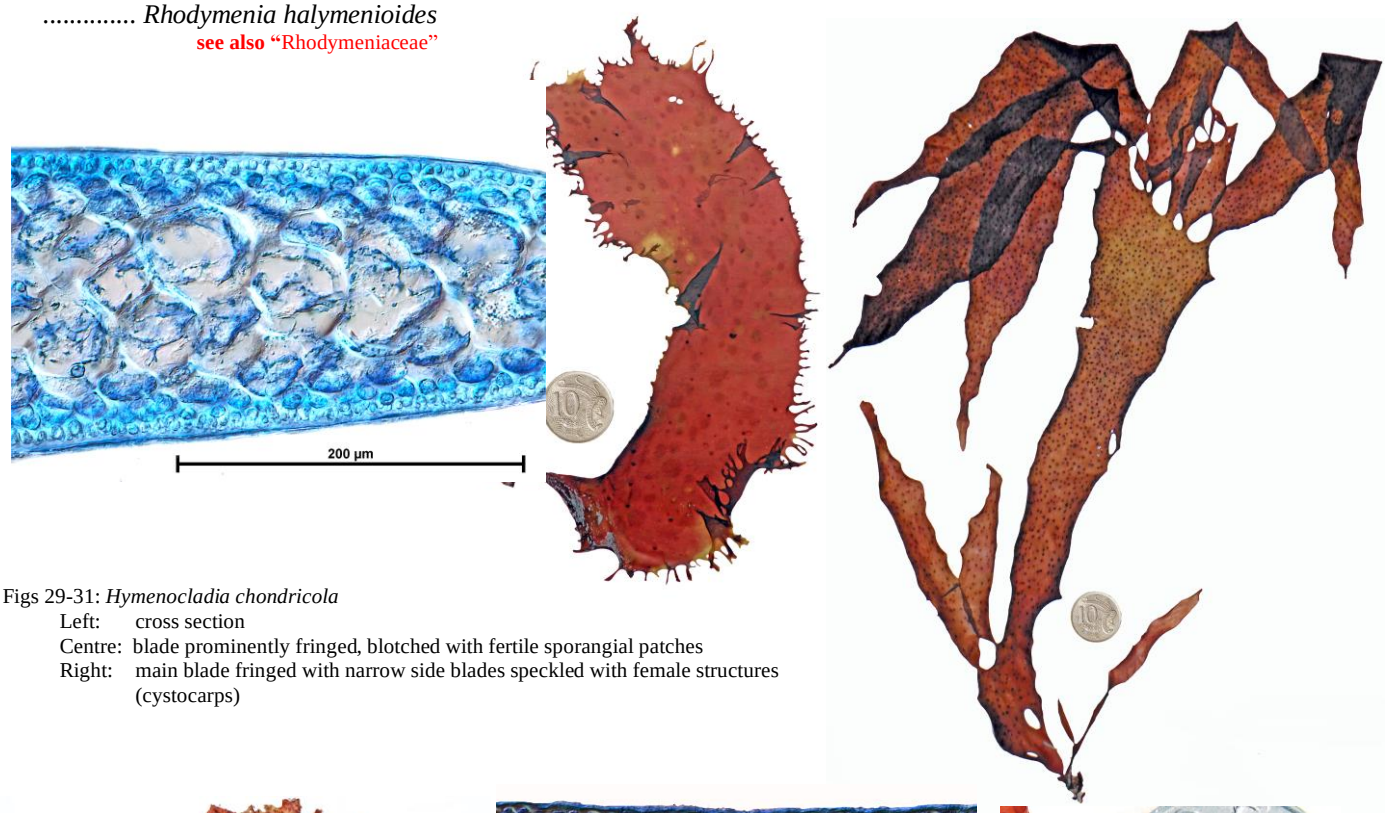
8b. plants smaller (5-20 mm tall) and paddle-shaped; cross sections show short chains facing outwards, of very small cells in outer layers (cortex). Figs 26-28.
..... *Erythrymenia minuta*
as *Perbella minuta* in *Algaebase*
Go to "Rhodymeniaceae"

9a. blade edges usually fringed with small, thin outgrowths, or with broader strap-like blades narrowed basally; spores scattered in the blades. Figs 29-31.
..... *Hymenocladia chondricola*
see also "Rhodymeniaceae"

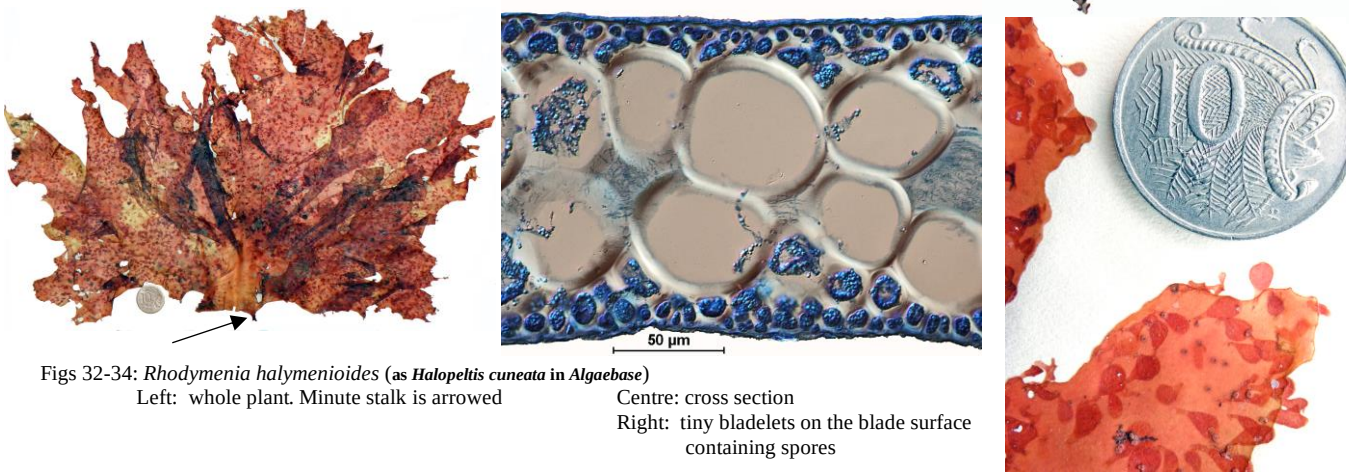
9b. blades edges frilly, patches of spores occur in tiny bladelets on the blade surface. Figs 32-34.
..... *Rhodymenia halymenioides*
see also "Rhodymeniaceae"



Figs 26-28: *Erythrymenia minuta*
Above, left: two small plants
Above, right: numerous plants
Left: cross section at blade edge, thick-walled core cells of mixed sizes, outer layer of short, outward-facing chains of small cells



Figs 29-31: *Hymenocladia chondricola*
Left: cross section
Centre: blade prominently fringed, blotched with fertile sporangial patches
Right: main blade fringed with narrow side blades speckled with female structures (cystocarps)



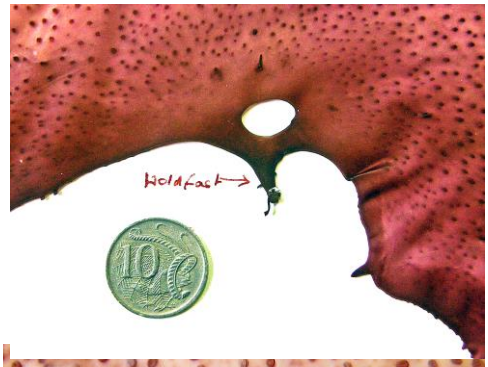
Figs 32-34: *Rhodymenia halymenioides* (**as *Halopeltis cuneata* in *Algaebase***)
Left: whole plant. Minute stalk is arrowed
Centre: cross section
Right: tiny bladelets on the blade surface containing spores

10a. female pustules (cystocarps) ***protrude*** from the blade surface ..... 11.

10b. fertile patches ***sunken*** into the blade surface ……..... 12.

11a. plants can be large (1m tall); blades gristly, ***broad*** at the base, attached by a tiny stalk; female pustules (cystocarps) on ***both*** the blade surfaces and edges. Figs 35-40. ..... *Sarcothalia radula*
go to "Gigartinaceae"

11b. blades lance-shaped, parchment-like and ***lustrous*** when dry; female pustules (cystocarps) only on the blade surface. Figs 41-43. ..... *Rhodoglossum gigartinoides*
(Variable Red alga)
go to "Gigartinaceae"



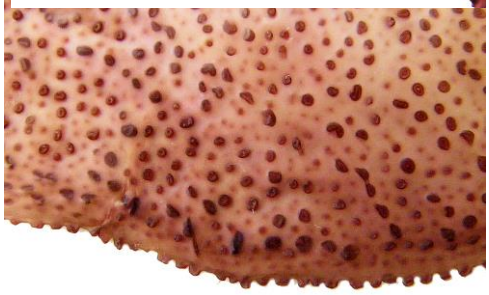
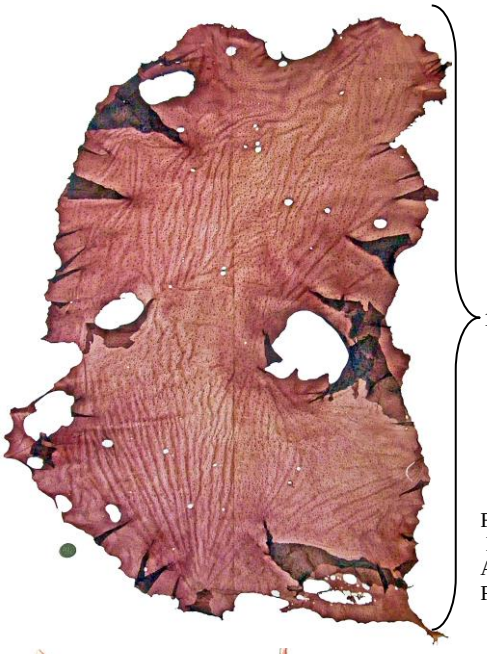


Fig. 35-37:*Sarcothalia radula*
Above: plant with tiny basal stalk (arrowed)
Right, top: detail of basal stalk
Right, bottom: detail of fertile pustules on blade surface and edge



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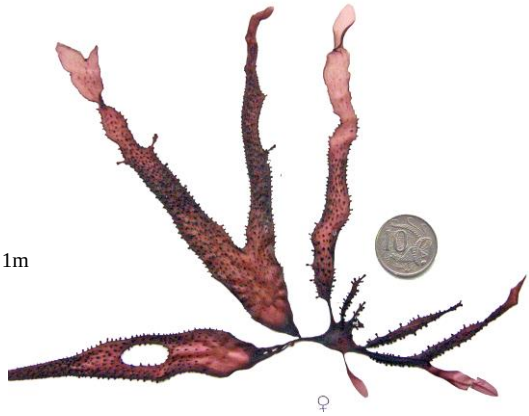
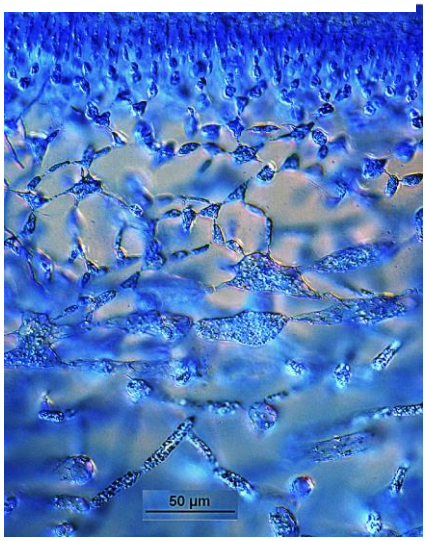
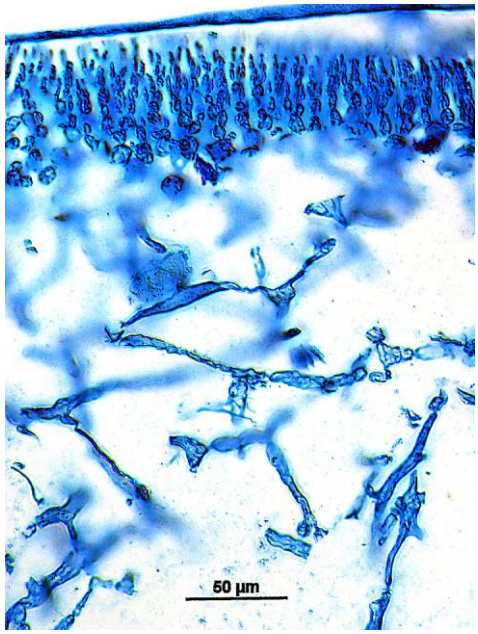




Figs 38-40: *Sarcothalia radula*
Left: large plant with parchment-like blade
Above: plant in which the blade has split into ribbons
Right: cross section, star-shaped cells in the wide core



Figs 41-43: *Rhodoglossum gigartinoides*
(Variable Red alga)
Left: two lance-shaped plants with lustrous blades
Centre: sporangial (left) and female fertile structures (right) on the surface of blades
Right: cross section

12a. tissue squashes or cross sections may show ganglionic cells ***present*** (cells with swollen centres and long arms) ……..……..…… 13.

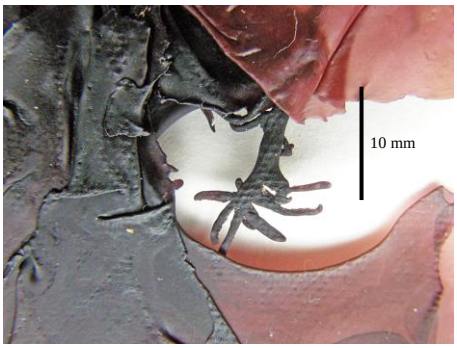
12b. (ganglionic) cells ***absent***; basal stalk and holdfast tiny. Figs 44-47.
……..……..… *Aeodes nitidissima*
go to "Halymeniaceae"

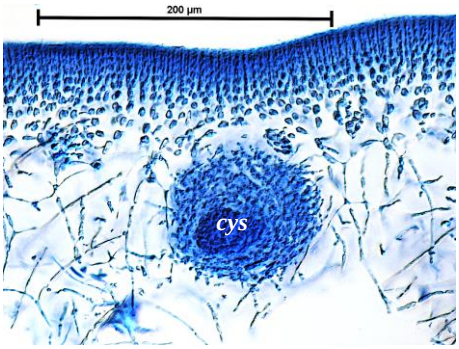
13a. tissue squashes show outer small cells in loose, branching sprays …….. 14.

13b. tissue squashes show outer small cells mostly in tight parallel rows ……..…… 15.

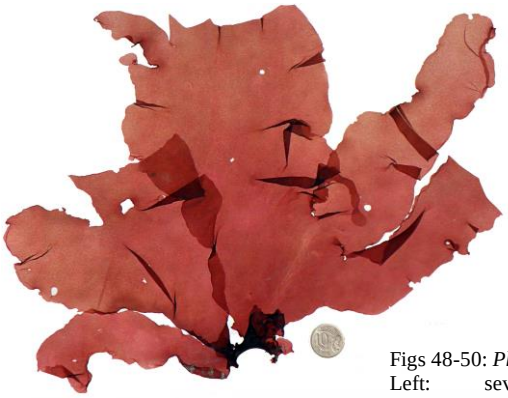
14a. several blades arise from a short stalk, ***stream-like patterns*** in surface view; tissue squashes show strings of 5-8 cells in sprays from the outer layers of blades. Figs 48-53.
……..……. *Platoma* 2 spp
go to "Nemastomataceae"

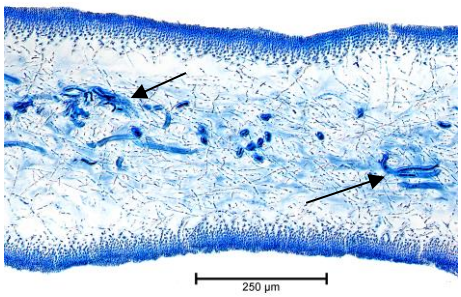
14b. blades single, or forked, stream-like surface patterns ***absent***; tissue squashes show strings of 4 cells in sprays from outer layers. Figs 54-56. (next page).
..... *Tsengia laingii*
go to "Nemastomataceae"

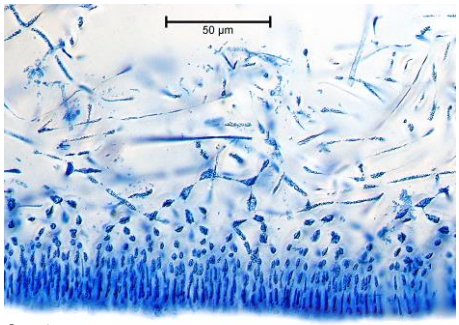




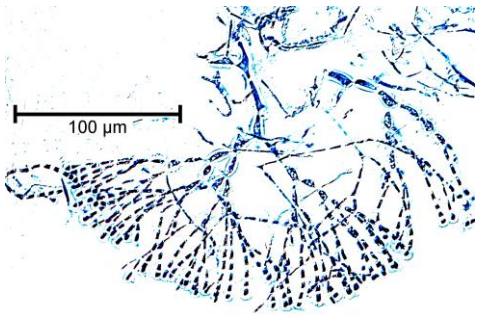
Figs 44-47:
Above, left: whole plant
Below, left: detail of frond fringes
Above, right: detail of tiny holdfast
Below, right: cross section, parallel chains of outer cells, core of fine threads, imbedded female structure (cystocarp, ***cys***)



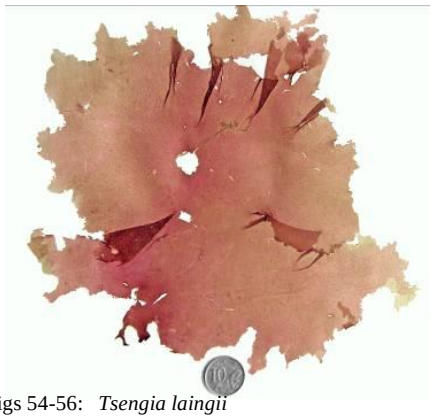


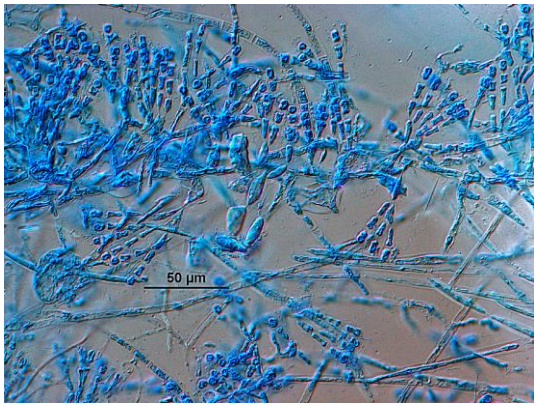


Figs 48-50: *Platoma australicum*, (**as *Wetherbeella australica* in *Algaebase***)
Left: several blades arising from a very short stalk
Above: cross section, outer layers of tightly packed, parallel strings of small cells, core of fine threads, anomalous densely stained blue-green bacterial threads infesting the blade (arrowed)
Right: cross section, detail of outer layers of tightly packed, parallel strings of small cells, branched threads of the core



Figs 51-53: *Platoma foliosum* (**as *Wetherbeella foliosum* in *Algaebase***)
Left: whole plant of several blades surface,
Centre: surface detail of surface blotches in stream-like patterns
Right: a single tuft dissected from the blade strings of cells about 8 cells long



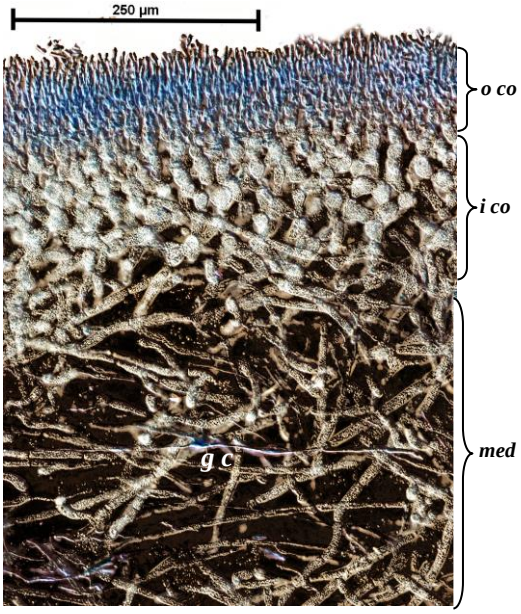


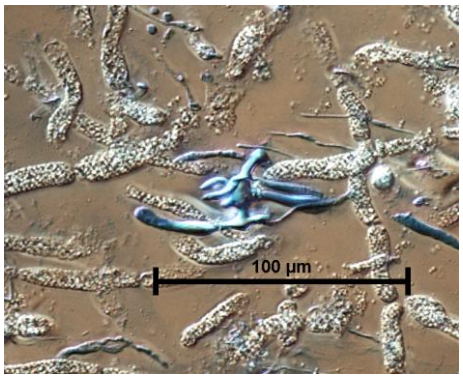
Figs 54-56: *Tsengia laingii*
Left: a piece of wide-bladed drift plant from SE of S Australia
Centre: narrow, divided blades in plants strings of only 4 cells in surface sprays
Right: tissue squash,

15a. blades can be slimy. Surface layers have microscopic sprays of cells with strings about 4 cells long ..... 16.

15b. blades can be large (>1m across), leathery, ***tough***, with a slight surface ***sheen***, sometimes divided at edges into lance-shaped side blades. Surface layers have microscopic sprays of cells in strings more than 10 cells long. Figs 57-61.
……...…… *Pachymenia orbicularis*
go to "Halymeniaceae"

Figs 57-61: *Pachymenia orbicularis*
Left: plant with lance-shaped branches at edges
Right: leathery plant, branching minimal





Figs 62-64: *Pachymenia orbicularis*
Left: cross section through outer layers, core (medulla, ***med***) long-armed cells (ganglionic cells, ***g c***) closely-packed strings of cells (outer cortex, ***o co***), more widely spaced cells (inner cortex, ***i co***)
Centre: tissue squash, bright, blue-stained ganglionic cell amongst threads of the core, containing bright starch grains
Right: large plant from 25 m deep off Kangaroo Island

16a. blades large compared to basal stalks, with a ***wide core*** of sparse, fine threads; outer sprays of cells with ***4-8*** cells in chains
……..…… 17.

16b. blades often divided; core narrower of mostly thicker, branched cells, outer sprays of cells with ***1-3*** cells in chains
…….. *Cryptonemia* in part Figs 65-69.
See also "Halymeniaceae"

17a. blades may be ***slimy***, divided into several large, roughly triangular blades narrowing rapidly to a very small common stalk. Figs 70-72.
……...…. *Schizymenia dubyi*
See also "Nemastomataceae"

17b. blades slimy or not, paddle-shaped or elongate-lance-shaped, female structures imbedded, cup-shaped. Long-armed ganglionic cells ***absent***.
……..…. 18.

18a. blades ***leathery***, usually single, broad, oval-shaped with tiny basal stalk. Figs 73-75 (next page).
…….... *Grateloupia ovata*
See also "Halymeniaceae"

18b. blades soft, slippery, ***ruffled at edges***. Figs 76-78 (next page)
……... **Grateloupia turuturu*
See also "Halymeniaceae"
an invasive pest species

Fig. 65: *Cryptonemia kallymenioides*

Fig. 66: *Cryptonemia wilsonis*

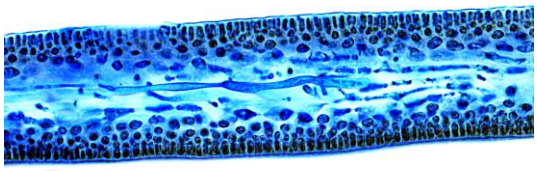


Fig. 67: *Cryptonemia wilsonis*, cross section, narrow core with long-armed cell present, surface layers of chains 1-4 cells long

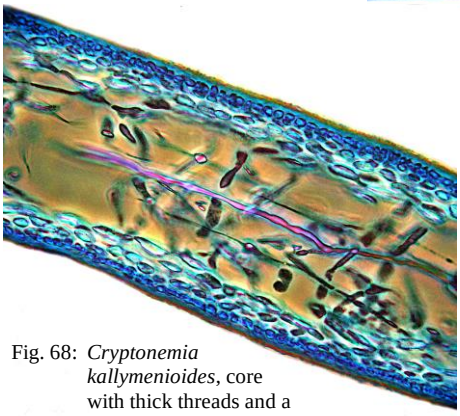


Fig. 68: *Cryptonemia kallymenioides*, core with thick threads and a Single, bright (pink) ganglionic cell; surface layers several cells thick

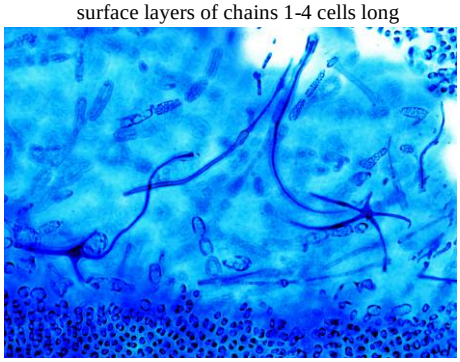
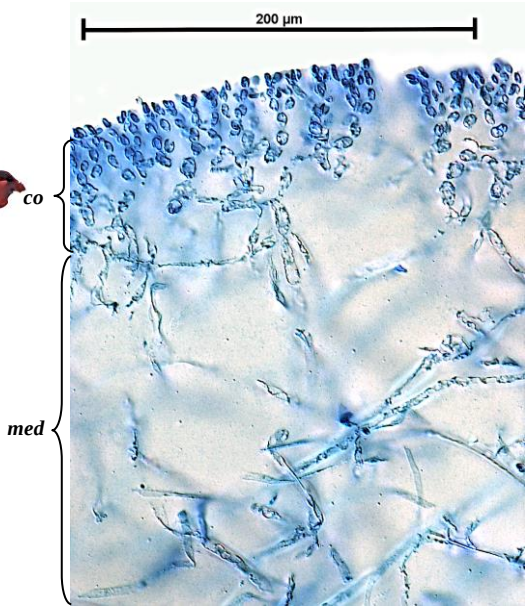
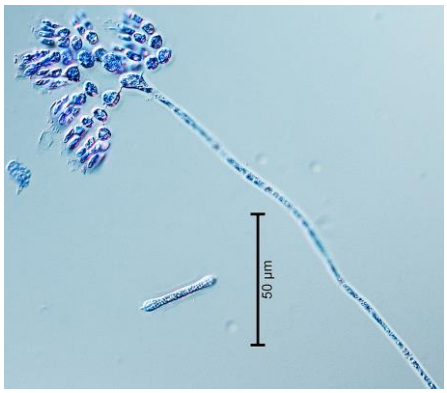


Fig. 69 (right): *Cryptonemia wilsonis*, tissue squash, long-armed ganglionic cells prominent

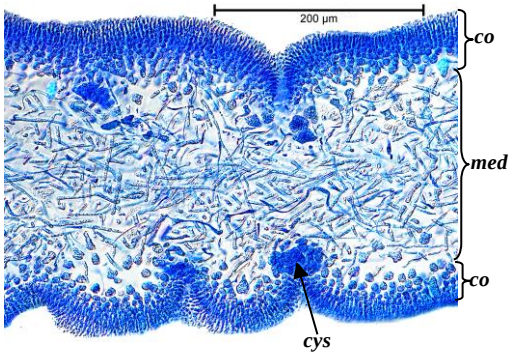
Figs 70: *Schizymenia* dubyi, whole plant



Figs 71: *Schizymenia dubyi* cross section, wide core (medulla, ***med***), outer layers (cortex. ***co***) of sprays of small cells



Figs 72: Single surface (cortex) spray, at the end of a thread dissected from the core of a blade



Figs 73-74: *Grateloupia ovata*
Far left: large plant with tiny basal stalk (arrowed)
Centre: cross section near blade edge, part of a wide core (medulla, ***med***) and outer layer (cortex, ***co***), female cystocarp (***cys***) beneath an indentation in the blade
Right: detail of the tiny basal stalk and holdfast that secure the large blade to a substrate

Fig. 75: *Grateloupia ovata*
detail of the tiny basal stalk and holdfast that secure the large blade to a substrate

Figs 76, 77: **Grateloupia turuturu*, (Japanese Slipperweed): variation in shape of whole plants

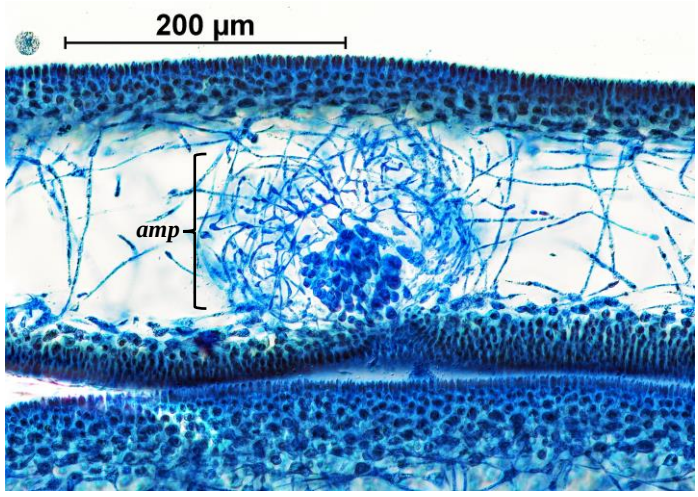


Fig. 78 **Grateloupia turuturu*, (Japanese Slipperweed): cross section, carposporangial spores wrapped loosely with filaments into an ampulla (***amp***)

LIST OF SPECIES ILLUSTRATED

species	author(s)	page(s)	current name in *Algaebase*	author(s)
Aeodes nitidissima	J. Agardh	7		
Cryptonemia kallymenioides	(Harvey) Kraft	9		
Cryptonemia wilsonis	J. Agardh	9		
Cryptonemia wilsonis	J. Agardh	9		
Erythrymenia minuta	Kylin	3, 5	*Perbella minuta*	(Kylin) Filloramo & G.W.Saunders
Grateloupia ovata	Womersley & J. A. Lewis	10		
Grateloupia turuturu,	Y. Yamada	10		
Halymenia kraftii	Womersley & J.A.Lewis	3		
Halymenia muelleri	Sonder	3		
Halymenia plana	Zanardini	3		
Hymenocladia chondricola	(Sonder) J.A.Lewis	5		
Kallymenia cribrogloea	Womersley & R.E.Norris	3	*Austrokallymenia cribrogloea*	(Womersley & R.E.Norris) Huisman & G.W.Saunders
Kallymenia cribrosa	Harvey	3	*Leiomenia cribrosa*	(Harvey)) Huisman & G.W.Saunders
Kallymenia rubra	Womersley & R.E.Norris	3		
Kallymenia spinosa	Womersley & R.E.Norris	3		
Lenormandia latifolia	Harvey & Greville	4		
Leptosomia rosea	(Harvey) Womersley	2		
Pachymenia orbicularis	(Zanardini) Setchell & Gardner	8		
Platoma australicum	Womersley & Kraft	7	*Wetherbeella australicum*	(Womersley & Kraft) Saunders & Kraft
Platoma foliosum	Womersley & Kraft	7	*Wetherbeella foliosa*	(Womersley & Kraft) Saunders & Kraft
Porphyra columbina	Montagne	2	*Pyropia columbina*	(Montagne) W.A.Nelson
Porphyra lucasii	Levring	2		
Porphyra woolhousiae	Harvey	2	*Porphyra* woolhouseae	Harvey
Predaea huismanii	Kraft	4		
Rhodoglossum gigartinoides	(Sonder) Edyvane & Womersley	6		
Rhodymenia halymenioides	(J. Agardh) Womersley	5	*Halopeltis cuneata*	(Harvey) G. W. Saunders
Sarcothalia radula	(Esper) Edyvane & Womersley	6		
Schizymenia dubyi	(Chauvin *ex* Duby) J. Agardh	9		
Schizymenia dubyi	(Chauvin *ex* Duby)	9		
Tsengia laingii	(Kylin) Womersley	8		