

Table S1. Identification key with the anatomical and reproductive features characterizing the genera and species found the study areas.

1. Sporangial compartments	Sporolithales
1. Multiporate sporangial conceptacles	Hapalidiales
1. Uniporate sporangial conceptacles	Corallinales
Sporolithales	
1. Few sporangial cavities per sori	2
2. Sporangial compartments < 70 µm in height	3
3. Ovoid sporangial cavities in section; 30-40 in diameter (D), 50-70 µm in height (H)	<i>Sporolithon liberum</i> (Lemoine) Aguirre and Braga
2. Sporangial compartments > 70 µm in height	4
4. Ovoid sporangial cavities in section; D = 40-50 µm, H = 70-75 µm	<i>Sporolithon</i> cf. <i>oulanovi</i> Pfender
4. Large sporangial cavities in nemathecium-like protruding sori; sporangial cavities circular in section; D = 120-170, H = 130-170 µm	<i>Sporolithon</i> sp.#
1. Numerous sporangial cavities per sori	3
3. Sporangial cavities rectangular in section and narrow; D = 40-50 µm, H = 70-90 µm	<i>Sporolithon lugeonii</i> (Pfender) Ghosh and Maithy
3. Sporangial cavities ovoidal-rectangular in section; D = 60-70 µm, H = 100-120 µm	<i>Sporolithon nummuliticum</i> (Gümbel) Moussavian
Hapalidiales	
1. Thallus dimerous	<i>Melobesia</i> sp.
1. Thallus monomerous	2
2. Plumose ventral core	3
3. Thin encrusting thalli	4
4. Groups of protrudent sporangial conceptacles piled up in warts	5
5. Rectangular-ovoidal conceptacles in section < 200 µm in diameter	<i>Lithothamnion</i> sp. 1‡
5. Lenticular (planar bottom and high arched roof) conceptacles in section > 200 µm in diameter	<i>Lithothamnion</i> sp. 2
4. Protrudent sporangial conceptacles isolated in the thallus	<i>Lithothamnion</i> sp. 3
3. Warty to fruticose thalli	6
6. Regularly zonate thallus	7
7. Protrudent sporangial conceptacles < 200 µm in diameter	<i>Lithothamnion</i> sp 4
7. Slightly protrudent sporangial conceptacles > 200 µm in diameter	8
8. Rectangular conceptacles in section	<i>Lithothamnion camarasae</i> Pfender
8. Flat elongated rectangular conceptacles in section	' <i>Palaeothamnium</i> ' <i>kossovense</i> Maslov†
6. Irregularly zonate thallus	9
9. Large rectangular-polygonal cells with no lateral alignment of cells in adjacent filaments; thick cell walls	<i>Lithothamnion corallinaeforme</i> Lemoine
9. Rectangular cells in the dorsal region with well lateral alignment of cells in adjacent filaments	<i>Lithothamnion</i> sp 5
2. Coaxial or nearly coaxial ventral core	10
10. Encrusting thalli, sporangial conceptacles ~200 µm in diameter	<i>Mesophyllum</i> sp 1
10. Fruticose thalli, sporangial conceptacles > 400 µm in diameter	<i>Mesophyllum</i> sp 2

Corallinales

1. Geniculate thallus; medulla made up of large, polygonal cells	<i>Subterraniophyllum thomasi</i> Elliott	
1. Non-geniculate thallus		2
2. Thallus dimerous		3
2. Thallus monomerous		4
3. Large, rectangular ventral palisade-cell filaments	<i>Lithoporella</i> sp.	
3. Ventral layer of irregular cell filaments	<i>Karpathia sphaerocellulosa</i> Maslov	
3. Ventral layer of quadrangular cells	<i>Hydrolithon</i> cf. <i>lemoinei</i> (Miranda) Aguirre, Braga, Bassi	
3. Isobilateral organization of the ventral filaments	<i>Distichoplax biserialis</i> Dietrich	
4. Plumose ventral core; absence of trichocytes		5
5. Sporangial conceptacle triangular in section; long pore canal with straight, parallel walls	<i>Spongites</i> sp. 1*	
5. Lenticular sporangial conceptacles in section with short, conical pore canal	<i>Spongites</i> sp. 2**	
5. Rectangular, box-like sporangial conceptacles in section with rounded corners; long pore canal with straight, parallel walls	<i>Spongites</i> sp. 3	
5. Large, trapezoidal sporangial conceptacles in section; long, pointing pore canal	<i>Spongites</i> sp. 4§	
4. Mostly coaxial ventral core; trichocytes arranged in vertical rows		6
6. Kidney-shaped sporangial conceptacles in section; > 300 µm in diameter	<i>Neogoniolithon</i> sp. 1	
6. Triangular sporangial conceptacles in section; < 300 µm in diameter	<i>Neogoniolithon</i> sp. 2	

The size of the sporangial cavities is similar to that of the Oligocene species *Sporolithon macrosporangicum* and the recent *S. episoredion*. Nonetheless, the arrangement of sporangial cavities in nemathecium-like structures and the general thallus morphology in *Sporolithon* sp. are different from *S. macrosporangicum* and *S. episoredion*.

‡ This species shows similar thallus organization and reproductive structures arranged in protuberant knobs as *Lithothamnion cymbicrustra*, but sporangial conceptacles are larger than those of the study material.

† The generitype *Palaeothamnium* was considered a younger heterotypic synonym of *Lithothamnion* and the type species *P. archaeotypum* was redescribed as *Lithothamnion archaeotypum*. Revision of the type material of *P. kossovense* showed that the species couldn't be reliably attributed to any genera of the Hapalidiales due to the lack of epithallial cells.

* Anatomical features and reproductive structures of this species fit with the original description of the species ?*Lithophyllum perrandoi* or *Lithophyllum ippolitoi*. Cell fusions are clearly visible in the original figures of these two species; therefore, they cannot be assigned to the subfamily Lithophylloideae.

** Anatomical features and reproductive structures of this species fit with the original description of *Lithophyllum kamptneri*. Cell fusions are clearly visible in the original figurations of this species; therefore, they cannot be assigned to the subfamily Lithophyloideae.

§ The shape and size of the sporangial conceptacles are similar to *Lithophyllum intumescens* Mastorilli. Nonetheless, the observed material is based on thallus fragments; therefore, comparison of anatomical characters is precluded. In the original description of the species, Mastorilli highlighted the presence of cell fusions in the ventral core: “*Peraltro, questo secondo caso si ritiene piuttosto la conseguenza dell’avventuna fusione degli elementi di due serie parallele, osservandosi qua e là ancora qualche traccia dei sretti orizzontali riparmiti in parte dal riassorbimento*”. Therefore, the species cannot be included within the subfamily Lithophylloideae.