

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

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| 1. Sporangial compartments   | <b>Sporolithales</b>                                   |
| 1. Multiporate sporangial conceptacles   | <b>Hapalidiales</b>                                    |
| 1. Uniporate sporangial conceptacles   | <b>Corallinales</b>                                    |
| <b>Sporolithales</b>   |  |
| 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>oulianoi</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    |
| <b>Hapalidiales</b>  |  |
| 1. Thalus 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                                |

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**Corallinales**

|   |  |   |
|---|--|---|
| 1. Genuculate thallus; medulla made up of large, polygonal cells  | <i>Subterraniophyllum thomasii</i> Elliott                             |   |
| 1. Non-genuculate 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  |   |

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# 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 figurations 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* Mastorrilli. Nonetheless, the observed material is based on thallus fragments; therefore, comparison of anatomical characters is precluded. In the original description of the species, Mastorrilli 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 Lithophyloideae.