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of the Coniston Limestone (now Dent Group) in the
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Introduction

The Coniston Limestone (now called the Dent Group) crops out along a narrow strip of land running from the south-western coast of Cumbria to the eastern fells in the neighbourhood of Shap. The outcrops have a varied lithology, consisting for the most part of a lime-mud mixed with varying proportions of clay, silt and occasional layers of rhyolite lava. The sediments formed in a shallow sea near the margin of the Borrowdale Volcanic Province. The rocks are of Upper Ordovician age. The stratigraphy and lithology have been described by Shackleton (1975), Ingham *et al.* (1978) and McNamara (1979) and summarised by Bassett *et al.* (1992). While the Coniston Limestone consists largely of calcareous sediment, the amount of carbonate varies widely and falls close to zero in some areas. Consequently, the flora associated with these rocks, while tending to be base-demanding, includes many calcifuge species, leading to an exceptionally rich flora. At outcrop, the limestones are most often found finely interbedded with harder mudstones and silts resulting in a surface showing strong differential weathering, with a characteristic indented and layered structure (opposite). This weathering is almost certainly subaerial but is not always present. In the west near Millom, the limestone is more massive and less obviously layered. Despite the high proportion of carbonate, the rock is often extremely hard showing little tendency to split despite much evidence of cleavage. In parts of its western outcrop it is dolomitized and then erodes less readily than the associated pelites. It is often crossed by veins of calcite and quartz. The outcrop as mapped by the Geological Survey drift edition covers an area of about 4.4 km², but only a proportion of this is exposed for study, and of that, probably less than half has sufficient carbonate to be called a limestone. The mean annual temperature is estimated to be 7–8°C with total annual precipitation ranging from 1500 mm to 3000 mm for most of the range.

The main outcrop is about 45 km in length (Fig. 1, p. 18) but there are many breaks in exposure caused by burial under drift and a number of displacements resulting from N–S trending faults. Altitude ranges from around 45 m to 600 m reaching a maximum



Plate 1. Outcrop of the Coniston Limestone Formation below High Pike Haw (SD264949) showing deep weathering of the limestone layers and near-vertical cleavage, which also influences plant distribution. The bright green-yellow lichen is *Rhizocarpon geographicum* with some pale patches of *Pertusaria* species. The moss in the crevice at lower right is *Polytrichastrum formosum*. (See p. 21.)

on Harrop Pike, but here, and on Great Yarlside nearby, the outcrops consist almost entirely of the acidic Yarlside rhyolite with associated silts. There is a general increase in height proceeding from west to east. South-facing outcrops are common and tend to be less steep than other aspects. Several watercourses flow over the formation but seepages are infrequent, although the formation descends to Windermere and occurs in the lake littoral. Rocks of the same age occur in a large inlier below the North Pennines and at Cautley Spout on the Howgill Fells. Their lithology differs from the main outcrop and they are not considered here.

Earlier floras have paid scant attention to this feature, despite the fact that it can often be picked out in the fells by its bright green vegetation. Wilson (1938) believed the rocks exerted little effect over the local flora and Halliday (1997) came to the same conclusion. Apart from the occurrence of the (non-native) fern *Matteuccia struthiopteris* from the quarry at Thieves Hole, Skelghyll, there appears to be no direct reference to vascular plants recorded from these rocks. The cryptogams have received a little more attention though no systematic work has been done. Wilson appended a small list of bryophytes from a site ‘on the east side of the Troutbeck Valley’, probably

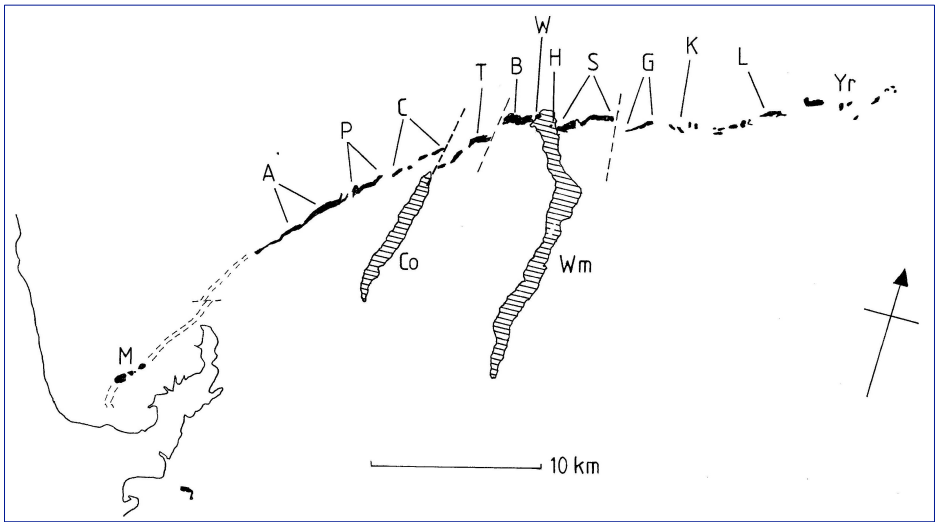


Figure 1.
Outcrops of the Coniston Limestone Formation in Cumbria showing locations of the sampling areas (see text). Breaks are caused by accumulation of drift. Broken lines indicate faults. Co Coniston Water, Wm Windermere, Yr Yarlside Rhyolite.

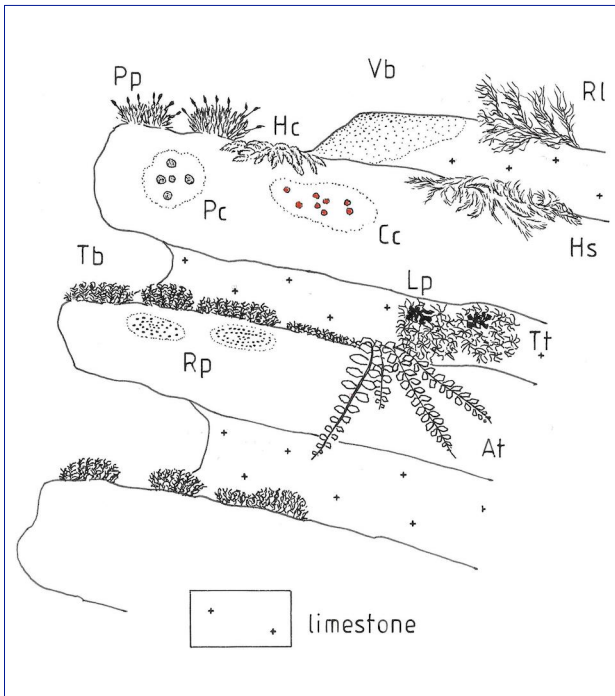


Figure 2.
Diagram showing a typical outcrop with interbedded limestone and siltstone. The limestone is undercut by weathering and the resulting recesses are often too dry to support plants except at the base where water collects and bryophytes become conspicuous.

At *Asplenium trichomanes*; Cc *Caloplaca crenularia*; Hc *Hypnum cupressiforme*; Hs *Homalo-thecium sericeum*; Lp *Leptogium pulvinatum*; Pc *Porpidia cinereoatra*; Pp *Ptychomitrium polyphyllum*; RI *Racomitrium lanuginosum*; Rp *Rhizocarpon petraeum*; Tb *Tortella bam-bergeri*; Tt *Tortella tortuosa*; Vb *Verrucaria baldensis*.

the outcrops near the Garburn Road above Applethwaite Common (NY4203) and Martindale (1886–90) recorded *Peltigera leucophlebia* and *Thermutis velutina* near Kentmere Hall, almost certainly from the Coniston Limestone.

Sites were visited between 2008 and 2020, often on several occasions. Sampling was entirely qualitative although notes were kept on the relative frequency of the species. Small samples of critical material were removed for microscopic examination/chemical tests and some material passed to experts for confirmed identification. Nomenclature follows Blockeel & Long (1998) for bryophytes, Smith *et al.* (2009) for lichens, Stace (1991) for pteridophytes.

The Coniston Limestone was divided into twelve sections to facilitate recording, as shown on Figure 1. Individual sites within the section are listed below, with their National Grid Reference and altitude. They are referred to below when of interest. Since most outcrops have a varied lithology, recording from the individual facies of the series was impracticable. An attempt was made to cover the entire length of the outcrop but many sites had to be ignored and the following list should be regarded as preliminary.

Sections (see Fig. 1 for locations)

- A **Appletreeworth:** SD244926, 200 m.
- B **Brathay:** Holmstead Farm SD164815, 90 m.
- C **Coniston Old Man:** Upper car park SD286972, 270 m; footpath boulders SD287973, 220 m; Limestone Haws SD281968, 300 m; Timley Knott SD284970, 280 m; Ashgill Beck east side SD269956, 310; Flask Brow SD272958, 320 m; Willy Scrow SD284975 180 m.
- G **Garburn Pass:** NY423035 to NY431042, 290–440 m.
- H **Holme Crag:** Windermere NY378025, 40 m.
- K **Kentmere Hall:** Kentmere NY449043, 190–220 m; field boulders NY451040, 180 m.
- L **Longsleddale:** Stockdale NY492054, 220 m.
- M **Millom:** Low House fields SD164815(-816), 40 m; Waterblean Quarry SD174824, 30 m.
- P **Pike Haws:** Coniston. High Pike Haw SD264949, 350 m; Low Pike Haw SD261945 300m; Ease Gill, east side SD269955, 310 m.
- S **Skelghyll:** Ambleside. Skelghyll Farm NY391030–392030, 230-250 m; Dovenest NY383025, 50 m; Skelghyll upper woods NY386030, 200 m.
- T **Tarn Hows:** SD329996, 200 m.
- W **Windermere:** Pwll and Sandy Wyke NY365023, 40 m.

Results and discussion

The cryptogams contained a mix of calcifuge and calcicole species, reflecting the diverse lithology of the formation. The species lists are shown in the Appendices. The species are discussed with reference to three ecological groups: taxa usually confined to pure limestones, taxa characteristic of mildly base-rich rocks and taxa associated with base-poor rocks. For the lichens, a total of 92 taxa can be assigned to the first group, 40 to the second and 89 to the third. For the bryophytes the totals are 37, 24 and 35 respectively, although here the distinction between limestone species and other groups is more blurred. Of the lichens, by far the largest proportion (90%) were chlorolichens and of these, crustose and placodioid species predominated (81%). The remaining species included the macrolichens, with 15 fruticose and 19 foliose taxa. Macrolichens were much less in evidence in terms of abundance, reflecting the significant site exposure and mainly oligotrophic nature of the substratum. The remaining lichens include a significant proportion of cyanolichens (36 taxa, 16% of the total), plus five tripartite species (those containing a cyanobacterium and a green alga) and one basidiolichen.

The first group, containing species characteristic of ‘pure’ limestones, was found across the whole outcrop. Common crustose lichens in the more exposed outcrops were *Caloplaca flavovirescens*, *Catillaria chalybeia*, *Protoblastenia rupestris*, *Verrucaria fuscella* and *V. nigrescens*. Crusts found in more sheltered sites often included *Gyalecta jenensis*, *Lepraria nivalis*, *Placynthium nigrum* and *Verrucaria baldensis*. This last species, although widespread on the Coniston Limestone proper was rarely abundant and was the only widely distributed endolithic species. Endolithic lichens have their cortical hyphae and algal layer buried in the rock to a depth of several millimetres. There are several common species on the Cumbrian Carboniferous limestones and their scarcity on the Coniston Limestone is probably due to the low calcium carbonate content, inhibiting the etching ability of the hyphae and thus their colonisation. They tended to be more evident in the Millom area where the limestone is of a higher purity. Common foliose/squamulose lichens were *Agonimia tristicula*, *Collema cristatum*, *C. fuscovirens* and *Leptogium pulvinatum*. These taxa preferred sites which remained wet for prolonged periods such as temporary seeps and crevices. *Leptogium pulvinatum*, and a few other morphologically similar cyanolichens such as *L. gelatinosum*, *L. intermedium* and *L. schraderei*, were usually associated with cushion mosses such as *Tortella tortuosa* (Fig. 2). A number of other limestone lichens, although present, were much less well represented here than on the Carboniferous limestones. These include *Aspicilia*

calcareo, *A. contorta*, *Caloplaca dichroa*, *C. flavescens* and *Lecanora albescens*, common taxa associated to some degree with bird excreta; *Acrocordia conoidea*, a pyrenocarpous lichen of shaded rock; *Petractis clausa*, characteristic of damp horizontal limestone slabs; and *Solenopsora candicans*, a species of exposed but sloping slabs. A few species common and widespread on the Cumbrian Carboniferous limestones appeared to be entirely absent, namely *Clauzadea immersa*, *Rhizocarpon umbilicatum* and *Toninia sedifolia*. Other notable Coniston limestone species include *Dermatocarpon miniatum*, one of the few umbilicate lichens characteristic of damp shaded runnels, along with two species characteristic of exposed soil-filled crevices, *Romjularia lurida* and *Toninia aromatica*. A third species often associated with these on the Carboniferous limestone, *Placidium squamulosum*, was not recorded. Several rare or uncommon limestone lichens were also found. Notable among them were the pyrenocarps *Polyblastia verrucosa* and *Verrucaria pinguicula* and the cyanolichens *Porocyphus coccodes* and *Psorotichia schaeereri*. *Diploschistes gypsaceus*, a striking and rare shade species, was found at one sheltered site on Coniston Old Man. The tripartite lichen *Peltigera leucophlebia* was rediscovered in Kentmere, where it had been first found by Martindale (*op. cit.*). Around a dozen large and healthy thalli were found there and a few further thalli were found among rocks at the Garburn site not far to the west. This is an uncommon species in Cumbria, usually associated with the Carboniferous limestones but it also occurs in the fells where some base is present.

Among the bryophytes, the commonest limestone species of the more exposed sites were *Homalothecium sericeum*, *Tortella bambergeri*, *T. tortuosa* and *Hypnum cupressiforme* var. *lacunosum* – and the latter is probably more common than the records suggest. *Tortella bambergeri* is a characteristic species of the limestone but is similar to *T. nitida*, which was also recorded. Specimens were found where it was not possible to distinguish between these two taxa. While *T. tortuosa* is a common species on Carboniferous limestones, the other two appear to be rare and small forms of this species can also be confused with the other two. All of these mosses were conspicuous on the ledges below the weathered limestone (Plate 1) and often grew in enlarged cleavage channels (Fig. 2). In more sheltered sites other bryophytes often became abundant. These included mosses *Anomodon viticulosus*, *Ctenidium molluscum*, *Fissidens dubius*, *F. taxifolius*, *Neckera crispa*, and *Thamnobryum alopecuroides*, with the liverworts *Metzgeria furcata*, *Porella arboris-vitae* and *P. platyphylla*. Of interest were *Encalypta streptocarpa*, *Gymnostomum aeruginosum*, *Plagiobryum zieri*, *Syntrichia intermedia* and liverworts *Cololejeunea calcarea* and *Preissia quadrata*. Ferns were not conspicuous on this formation and were usually

confined to sheltered cliffs and crevices. The most widespread calcicole was *Asplenium trichomanes* ssp. *quadrivalens*, which could usually be located in sheltered crevices. This was followed by *Cystopteris fragilis* but the plants were rarely seen well developed. Perhaps surprisingly, the calcicole *Asplenium adiantum-nigrum* was rare. *Asplenium viride* evidently occurs, as it was shown in the correct tetrads in Halliday (*op. cit.*) but was not seen in this survey.

The second ecological group associated with mildly base-rich rocks had many interesting taxa. Common lichen species in this group can be divided into three broad categories, those associated with drier and often more exposed sites, those of more sheltered and damper areas and those within runnels, streams or in the littoral zone of Windermere. These last are often grouped together as amphibious taxa. The first group containing the xerophytes includes several common forms, namely *Caloplaca crenularia*, *C. flavovirescens* and *Ochrolechia parella*. The last is particularly conspicuous, forming large pale patches on the exposed rocks. In more sheltered sites were *Collema flaccidum*, *Haematomma ochroleucum*, *Lecanora gangalaeoides*, *Lecidella scabra*, *Rhizocarpon obscuratum* f. *cinereum* and *R. petraeum*. Several rare species belong here, including the chlorolichen *Lecania sylvestris* and the leafy pyrenocarps *Dermatocarpon intestiniforme* and *Endocarpon adscendens*. These last two were found in the upper littoral of Windermere and are known from a few other littoral sites in the county. The amphibious lichens were of much interest. In the littoral of Windermere, where the Coniston formation crops out on both sides of the lake, were several rare cyanolichens. On the eastern side, *Collema dichotomum*, *Porocyphus kenmorensis* and cf. *Anema decipiens* occurred. The *Collema*, a red-data species and the *Porocyphus* were recently found in the Windermere littoral on other formations to the north but both are rare throughout the country. A lichen closely resembling *Anema decipiens*, a rare continental species, was noted at the water-line on Holme Crag island. It was associated with the *Porocyphus* but the material was too fragmentary to confirm the identification. *Pyrenopsis subaerolata* is a rare species of base-rich seepages and was found at two places, being locally abundant at Garburn Pass. Here the lichen was easily identified by its irregular jet-black thalli dotted with deep red semi-immersed apothecia. Another runnel species, *Thermutis velutina*, occurred locally at Skelghyll. This lichen was first discovered in Cumbria by Martindale at Kentmere, almost certainly on the Coniston outcrops but this is the first modern sighting. *Protopannaria pezizoides* is not a runnel species but occurs on sheltered rock with constant high humidity. It is rare in England and was found at two locations on the limestone below Coniston Old Man. A single thallus was seen on a

boulder near the main footpath to the summit, but a second site was later discovered in a disused slate quarry at Flask Brow. Here the limestone crops out near the quarry floor and revealed at least a dozen well fertile thalli. Three nationally important foliose species occur in this group and all are rare in the county. These are *Lobaria virens*, found on rock with *Nephroma* near Coniston at Willy Scrow and *Sticta canariensis*, which was found on rock close to Pwll Wyke and was also associated with the *Lobaria* above. Only the blue-green form containing the cyanobacterium *Nostoc* was encountered in this survey.

Most of the bryophytes found on the limestone proper also occurred on the base-enriched rocks but the diversity here increased with frequent *Pterogonium gracile*, *Ptychomitrium polyphyllum*, *Thuidium tamariscinum* and *Frullania fragilifolia*. A number of interesting species were also recorded such as *Isothecium alopecuroides* and *Frullania microphylla*. Wetter facies had locally *Bryum pseudotriquetrum*, *Cratoneuron filicinum*, *Palustriella commutata*, *Philonotis calcarea* with liverworts *Jungermannia atrovirens* and *Pellia endiviifolia*. A significant number of bryophytes regularly seen on the local Carboniferous limestones appeared to be absent. These included the mosses *Didymodon recurvirostrum*, *D. tophaceus*, *Eucladium verticillatum*, *Fissidens adiathoides*, *F. cristatus*, *Rhynchostegiella tenella* and *Tortula ruralis* and the leafy liverworts *Marchesinia mackayi* and *Apometzgeria pubescens*. The strongly calcicolous mosses *Didymodon tophaceus* and *Eucladium verticillatum* were not seen and their absence must reflect the impurity and resistance of most of these limestones to weathering.

The third ecological group contains the calcifuge species. It contained few surprises, although a good range of common Cumbrian taxa occurred. Particularly common on exposed rocks were the lichens *Cladonia subcervicornis*, *Lecanora intricata*, *L. polytropa*, *Melanelixia fuliginosa*, *Parmelia saxatilis*, *Pertusaria corallina* and *Tephromela atra*. More sheltered formations had *Diploschistes scruposus*, *Pertusaria dealbescens*, *P. lactea*, *Opegrapha gyrocarpa* and *Porpidia cinereoatra*. Three nationally scarce species were seen, the cyanolichen *Euopsis* (sterile), and chlorolichens *Lecidea fuliginosa* and *Toninia thiopsora*. Three tripartite lichens were found on base-poor rock but only one of these was at all common on the formation – *Stereocaulon vesuvianum*. This lichen is widespread in the Cumbrian fells and grows preferentially on iron-rich substrata. In Cumbria however, cephalodium production is usually suppressed. A single crustose representative, *Amygdalaria consentiens*, was found in one spot near Coniston. The placodioid *Placopsis lambii* occurred on damp outcrops at Coniston. Like *Stereocaulon*, this

species is often found without cephalodia, as was the case here.

Common bryophytes on the base-depleted rocks were *Campylopus atrovirens*, *Dicranella heteromalla*, *Hypnum cupressiforme* var. *cupressiforme*, *Isothecium myosuroides*, *Mnium hornum*. *Polytrichum juniperinum* and *Racomitrium lanuginosum* with liverworts *Frullania dilatata*, *F. tamarisci* and *Metzgeria furcata*. *Isothecium* along with the above liverworts are best regarded as base-tolerant as they tend to occur on circumneutral rather than acidic substrata. *Racomitrium lanuginosum*, a calcifuge moss, formed thick springy tufts that may grow directly on the limestone and is presumably subject to a degree of isolation from base owing to its growth form. Among the more interesting calcifuge mosses was *Diphyscium foliosum*, a small species with distinctive sessile capsules. Ferns colonising the more acidic substrata included frequent *Dryopteris filix-mas* and perhaps other species of the genus while *Cryptogramma crispa* and *Blechnum spicant* were much less common.

In addition to the above, a few observations were made of flowering plants and freshwater algae. There was no systematic investigation, but chance observations suggest that more a more detailed investigation would be rewarding. Particularly widespread and common calcicoles included *Campanula rotundifolia*, *Geranium robertianum*, *Oxalis acetosella*, *Sedum anglicum* and *Thymus polytrichus*. Others included *Ceratocarpus claviculata*, *Geranium lucidum*, *Hypericum hirsutum* and *Thalictrum minus*. Despite the suggestion that the formation had little effect on the vascular plant flora, seepages below the outcrops in the High Pike area had frequent *Parnassia palustris* indicating local base-enrichment. The most interesting of the freshwater algae were both Rhodophytes: *Chrootheca richterianum* from Thieves Hole, Skelghyll and *Hildenbrandtia rivularis* from Kentmere. The green alga *Hormidiopsis crenulata*, an indicator of air pollution (oxidized nitrogen) was widespread on base-poor outcrops of the formation. The cyanobacteria *Gloeocapsa compacta*, *Scytonema myochrous*, *Stigonema informe* and *S. minutum* were often conspicuous on the more basic outcrops, with brown-red strata of *Gloeocapsa sanguinea* agg. common on the more acidic ones.

From the above, it should be evident that the Coniston Limestone has an exceptionally rich cryptogam flora, owing to its varied lithology and complex surfaces, resulting from differential weathering. Particularly interesting were comparisons with the flora of local 'pure' Carboniferous limestones. A number of species occurring on the latter were absent or rare on the Coniston outcrops. Nonetheless, the Coniston Limestone is notable for its rare or uncommon lichens, especially amongst the cyanolichens. Further surveys will doubtless uncover

additional interesting finds. Eight of the lichen species asterisked in the Appendices are new vice-county records. All are for v.c. 69 (Westmorland) except *Lecania sylvicola* which is in v.c. 70 (Cumberland).

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Appendix (1/4). Coniston limestone cryptogam flora:

A Appletreeworth; B Brathay; C Coniston; G Garburn; H Holme Crag, Windermere; K Kentmere; L Longsleddale; M Millom; P Pike Haw; S Skelghyll & Dovenest; T Tarn Hows; W Windermere, Pwll & Sandy Wyke. Asterisks indicate new vice-county records.

Lichens

<i>Acarospora nitrophila*</i>	P
<i>Acarospora veronensis</i>	G, M
<i>Acrocordia conoidea</i>	M
<i>Acrocordia salweyi</i>	M
<i>Agonimia tristicula</i>	B, C, H, M, P, S, T
<i>Amandinea punctata</i>	C
<i>Amygdalaria consentiens</i>	C
<i>Anaptychia runcinata</i>	M
<i>cf Anema decipiens</i>	H
<i>Arthroraphis citrinella</i>	C, G
<i>Aspicilia caesiocinerea</i>	B, H, K, M, S
<i>Aspicilia calcarea</i>	H, M, S
<i>Aspicilia contorta</i>	
<i>subsp. contorta</i>	M
<i>Aspicilia cf. grisea</i>	C
<i>Bacidia viridifarinosa</i>	S
<i>Baeomyces rufus</i>	C, P, T
<i>Belonia nidarosiensis</i>	C, P, T
<i>Bilimbia sabuletorum</i>	C, M, T
<i>Botryolepraria lesdainii</i>	K, M
<i>Buellia aethalea</i>	H, S
<i>Buellia stellulata</i>	H
<i>Caloplaca chrysodeta</i>	A, C
<i>Caloplaca cirrochroa</i>	M
<i>Caloplaca citrina</i>	C, M, T
<i>Caloplaca crenularia</i>	B, C, H, M, S
<i>Caloplaca dichroa</i>	M
<i>Caloplaca flavescens</i>	C, M
<i>Caloplaca flavocitrina</i>	H
<i>Caloplaca flavovirescens</i>	H, G, K, L, M, S, T
<i>Caloplaca lactea</i>	M
<i>Candelariella vitellina</i>	C, H, K, M, P, S
<i>Catillaria atomarioides</i>	C, T
<i>Catillaria chalybeia</i>	C, W
<i>Catillaria chalybeia</i>	
<i>var. chloropoliza*</i>	T

<i>Catillaria lenticularis</i>	C, H, M, S
<i>Cladonia cervicornis</i>	G
<i>Cladonia diversa sensu lato</i>	C, T
<i>Cladonia fimbriata</i>	K
<i>Cladonia floerkeana</i>	C
<i>Cladonia furcata</i>	G, T
<i>Cladonia pocillum</i>	B, C
<i>Cladonia portentosa</i>	P, T
<i>Cladonia pyxidata</i>	C, T
<i>Cladonia rangiformis</i>	C, S, T
<i>Cladonia squamosa</i>	
<i>var. subsquamosa</i>	C
<i>Cladonia subcervicornis</i>	C, G, P, S, T
<i>Cladonia subulata</i>	T
<i>Cladonia uncialis</i>	T
<i>Clauzadea monticola</i>	C, G, K
<i>Collema auriforme</i>	H, M
<i>Collema crispum</i>	M
<i>Collema cristatum</i>	B, C, G, H, S, W
<i>Collema dichotomum</i>	H
<i>Collema flaccidum</i>	B, C, S
<i>Collema fuscovirens</i>	B, G, K, M, P, T
<i>Collema glebulentum</i>	C
<i>Collema subflaccidum</i>	C, S
<i>Collema tenax sensu lato</i>	P
<i>Dermatocarpon intestiniforme</i>	H
<i>Dermatocarpon miniatum</i>	B, H, M
<i>Dermatocarpon luridum</i>	W
<i>Dibaeis roseus</i>	C, G, P, T
<i>Dimerella lutea</i>	C
<i>Diploicia canescens</i>	M
<i>Diploschistes gypsaceus</i>	C
<i>Diploschistes scruposus</i>	C, P, T
<i>Diplotomma alboatrum</i>	M
<i>Dirina massiliensis f. sorediata</i>	C
<i>Endocarpon adscendens</i>	H
<i>Epebe lanata</i>	C
<i>Euopsis sp.</i>	H

Appendix (2/4)

<i>Fuscidea cyathoides</i>	C, G, P, T	<i>Lobaria virens</i>	C
<i>Fuscidea lygaea</i>	G, P, T	<i>Melanelixia fuliginosa</i>	B, C, M, S, T
<i>Gyalecta jenkins</i>	C, G, H, K, P, S, T	<i>Melanelixia glabrata</i>	A
<i>Haematomma ochroleucum</i>		<i>Micarea leprosula</i>	C, T
<i>var. porphyrium</i>	C, M, S	<i>Micarea lignaria</i>	T
<i>Haematomma ochroleucum</i>		<i>Mycobilimbia pilularis</i>	C
<i>var. ochroleucum</i>	M	<i>Nephroma laevigatum</i>	C
<i>Hymenelia prevostii</i>	H, T	<i>Ochrolechia androgyna</i>	T
<i>Hyperphyscia adglutinata</i>	M	<i>Ochrolechia parella</i>	A, B, C, G, H, M, P, S, T
<i>Hypotrachyna revoluta</i>	M, T	<i>Ochrolechia tartarea</i>	P
<i>Ionaspis lacustris</i>	A, C, G, P	<i>Opegrapha gyrocarpa</i>	A, C, G
<i>Ionaspis suavolens</i>	K	<i>Opegrapha rupestris</i>	H, M
<i>Lasallia pustulata</i>	H	<i>Opegrapha zonata</i>	A, C, T
<i>Lecania erysibe var. soralifera</i>	M	<i>Parmelia omphalodes</i>	P
<i>Lecania cf. hutchinsiae</i>	C	<i>Parmelia saxatilis</i>	B, C, G, M, P, S, T
<i>Lecania sylvicola*</i>	M	<i>Parmelia sulcata</i>	M
<i>Lecanora albescens</i>	H, M	<i>Peltigera didactyla</i>	B, H, M
<i>Lecanora campestris</i>	H, M	<i>Peltigera horizontalis</i>	B, C, H, K
<i>Lecanora crenulata</i>	L (wall), T	<i>Peltigera hymenina</i>	B, C, G, H, K, L, M, T
<i>Lecanora dispersa</i>	C, H, M	<i>Peltigera leucophlebia</i>	G, K
<i>Lecanora gangaleoides</i>	A, C, H, M	<i>Peltigera membranacea</i>	B, C, H, L, T
<i>Lecanora cf. hageni</i>	M	<i>Peltigera praetextata</i>	C
<i>Lecanora intricata</i>	C, G, M	<i>Peltigera rufescens</i>	C
<i>Lecanora muralis</i>	B, H, M	<i>Pertusaria albescens</i>	
<i>Lecanora orosthea</i>	C, M	<i>var. corallina</i>	C, M
<i>Lecanora polytropa</i>	G, H, M	<i>Pertusaria amara f. pulvinata</i>	B
<i>Lecanora rupicola</i>	M	<i>Pertusaria aspergilla</i>	C, G, P, T
<i>Lecanora sulphurea</i>	M	<i>Pertusaria corallina</i>	B, C, G, M, S, T
<i>Lecidea confluens</i>	M, S	<i>Pertusaria lactea</i>	B, C, S, T
<i>Lecidea fuliginosa</i>	C	<i>Pertusaria lactescens</i>	C
<i>Lecidea lactea</i>	C, S	<i>Pertusaria pertusa</i>	C, H
<i>Lecidea cf. paupercula</i>	C	<i>Pertusaria pseudocorallina</i>	C, M, T
<i>Lecidea cf. sanguinoatra</i>	C	<i>Petractis clausa</i>	K
<i>Lecidella scabra</i>	C, H, M, S, T	<i>Phaeophyscia orbicularis</i>	M
<i>Lecidella stigmatea</i>	C	<i>Phlyctis argena</i>	T
<i>Lepraria lobificans</i>	C	<i>Physcia adscendens</i>	C, M
<i>Lepraria nivalis</i>	A, C	<i>Physcia caesia</i>	H
<i>Leptogium cyanescens</i>	B	<i>Physcia tribacia</i>	M
<i>Leptogium gelatinosum</i>	B, H	<i>Placopsis lambii</i>	C
<i>Leptogium intermedium</i>	G, S	<i>Placynthium nigrum</i>	B, C, G, H, K, M, P, S, T
<i>Leptogium lichenoides</i>	C	<i>Placynthium subradiatum</i>	C
<i>Leptogium plicatile</i>	H	<i>Polyblastia albida</i>	B
<i>Leptogium pulvinatum</i>	B, C, G, H, P, T	<i>Polyblastia cruenta</i>	C, G
<i>Leptogium schraderi</i>	B	<i>Polyblastia dermatodes</i>	H, T
<i>Leptogium teretiusculum</i>	B, C	<i>Polyblastia verrucosa*</i>	G
<i>Lichenomphalina umbellifera</i>	S	<i>Polysporina simplex</i>	T



Appendix (3/4)

<i>Porina chlorotica</i>	C	<i>Verrucaria aethiobola</i>	C, H
<i>Porina lectissima</i>	C	<i>Verrucaria baldensis</i>	B, S, G, H, M, T
<i>Porina linearis</i>	M, S	<i>Verrucaria funckii</i>	C, K, W
<i>Porocyphus coccodes</i>	C	<i>Verrucaria fuscella</i>	G, H, M, P
<i>Porocyphus kenmorensis</i>	H	<i>Verrucaria hochstetteri</i>	K, M, T
<i>Porpidia cinereoatra</i>	C, G, M, P, S, T	<i>Verrucaria internigrescens</i>	C, W
<i>Porpidia crustulata</i>	G	<i>Verrucaria margacea</i>	C
<i>Porpidia macrocarpa</i>	C, G, T	<i>Verrucaria murina</i>	G, H
<i>Porpidia rugosa</i>	B, C, G, P, S, T	<i>Verrucaria nigrescens</i>	B, C, G, H, K, M, S, T
<i>Porpidia soredizodes</i>	C, G, P	<i>Verrucaria pinguicula*</i>	S
<i>Porpidia speirea</i>	B, G, T	<i>Verrucaria praetermissa</i>	K, W
<i>Porpidia tuberculosa</i>	C, G, P, T	<i>Verrucaria viridula</i>	C, H, K, S
<i>Protoblastenia calva</i>	G, H, K	<i>Xanthoparmelia conspersa</i>	C, H, K, M, S, T
<i>Protoblastenia incrustans</i>	G, K	<i>Xanthoria calcicola</i>	M
<i>Protoblastenia rupestris</i>	C, G, K, M, P, S, T	<i>Xanthoria parietina</i>	B, C
<i>Protopannaria pezizoides</i>	C		
<i>Psorotichia schaeeri</i>	B, M	Mosses	
<i>Pyrenopsis subareolata</i>	C, G	<i>Anoetangium aestivum</i>	H, M
<i>Ramalina subfarinacea</i>	C, M, T	<i>Anomodon viticulosus</i>	B, K, M
<i>Rhizocarpon geographicum</i>	A, C, G, M, P, S, T	<i>Atrichum undulatum</i>	C
<i>Rhizocarpon lavatum</i>	P, T	<i>Barbula convoluta</i>	T
<i>Rhizocarpon petraeum</i>	C, G, H, M, P, T	<i>cf. Blindia acuta</i>	K
<i>Rhizocarpon reductum</i>	C, G, S, T	<i>Brachythecium rivulare</i>	A
<i>Romjularia lurida</i>	C, G, K	<i>Breutelia chrysocoma</i>	G
<i>Sarcogyne regularis</i>	H, K	<i>Bryoerthrophyllum</i>	
<i>Scoliosporum umbrinum</i>	G	<i>recurvirostrum</i>	K
<i>Solenopsora candicans</i>	C, M, T	<i>Bryum alpinum</i>	G
<i>Solorina saccata</i>	K (old)	<i>Bryum capillare</i>	A, B, C, P
<i>Stereocaulon vesuvianum</i>	C, P, T	<i>Bryum pseudotriquetrum</i>	G
<i>Sticta canariensis*</i>	C, W	<i>Calliergionella cuspidata</i>	H, W
<i>Tephromela atra</i>	C, G, H, M, S, T	<i>Campylopus atrovirens</i>	
<i>Thelidium decipiens</i>	B, K	<i>var. atrovirens</i>	C
<i>Thelidium fontigenum*</i>	C	<i>Campylopus atrovirens</i>	
<i>Thelidium incavatum</i>	K	<i>var. falcatus</i>	P, T
<i>Thelidium microbolium</i>	H	<i>Campylopus flexuosus</i>	C, P
<i>Thelidium papulare</i>	G, H	<i>Campylopus introflexus</i>	T
<i>Thelidium pyrenophorum*</i>	C	<i>Cinclidotus fontinaloides</i>	H
<i>Thermutis velutina</i>	K (old), S	<i>Climacium dendroides</i>	H
<i>Toninia aromatica</i>	B, H, M, T	<i>Cratoneuron filicinum</i>	K
<i>Toninia thiopsora</i>	C	<i>Ctenidium molluscum</i>	C, G, H, K, M, S, T
<i>Trapelia coarctata</i>	B, C, G, K, M, P, T	<i>Dicranella heteromalla</i>	A, M, P
<i>Trapelia glebulosa</i>	B, M, P	<i>Dicranum scoparium</i>	S
<i>Trapelia placodioides</i>	G, P, T	<i>Didymodon insulanus</i>	C
<i>Trapeliopsis granulosa</i>	G	<i>Didymodon vinealis</i>	A
<i>Trapeliopsis pseudogranulosa</i>	C	<i>Diphyscium foliosum</i>	C, P
<i>Tremolecia atrata</i>	C, G		

Appendix (4/4)

<i>Encalypta streptocarpa</i>	C, G
<i>Eurhynchium striatum</i>	K
<i>Fissidens dubius</i>	A, B, K, P, T
<i>Fissidens taxifolius</i>	C, G, K, S
<i>Fontinalis antipyretica</i>	H, W
<i>Grimmia pulvinata</i>	C
<i>Grimmia trichophylla</i>	M
<i>Gymnostomum aeruginosum</i>	G
<i>Hedwigia ciliata</i>	C
<i>Homalothecium sericeum</i>	B, C, G, H, K, M, T
<i>Hymenostylium recurvirostrum</i>	C, S
<i>Hypnum cupressiforme</i>	B, C, G, M, P, S
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	C, T
<i>Isothecium alopecuroides</i>	P
<i>Isothecium myosuroides</i>	A, C, G, P, S
<i>Mnium hornum</i>	C, K, P
<i>Neckera complanata</i>	A
<i>Neckera crispa</i>	A, G, K, P, S, T
<i>Orthotrichum anomalum</i>	M
<i>Orthotrichum cupulatum</i>	C, G
<i>Palustriella commutata</i>	G, S
<i>Philonotis calcarea</i>	S
<i>Plagiobryum zierii</i>	C, G, K
<i>Plagiomnium affine</i>	C
<i>Plagiomnium cuspidatum</i>	M
<i>Plagiomnium punctatum</i>	K
<i>Polytrichastrum formosum</i>	P, T
<i>Polytrichum piliferum</i>	P
<i>Polytrichum juniperinum</i>	B, K, T
<i>Pseudocrossidium revolutum</i>	A
<i>Pseudoscleropodium purum</i>	S
<i>Pterogonium gracile</i>	B, C, K, S, T
<i>Ptychomitrium polyphyllum</i>	C, G, K
<i>Racomitrium aquaticum</i>	A
<i>Racomitrium lanuginosum</i>	C, G, K, M, P, T
<i>Rhizomnium undulatum</i>	C, K
<i>Rhytidiadelphus loreus</i>	K
<i>Rhytidiadelphus squarrosus</i>	B, S
<i>Schistidium rivulare</i>	W
<i>Syntrichia intermedia</i>	M
<i>Thamnobryum alopecurum</i>	B, K, W, S
<i>Thuidium tamariscinum</i>	A, K, T
<i>Tortula muralis</i>	M
<i>Tortula subulata</i>	K
<i>Tortella bambergeri</i>	C, H, T

<i>Tortella nitida</i>	C, G, P
<i>Tortella tortuosa</i>	A, C, G, K, M, S, T
<i>Trichostomum brachydontium</i>	K
<i>Trichostomum crispulum</i>	C
<i>Weissia controversa</i>	M

Liverworts

<i>Cephaloziella</i> spp.	C, P
<i>Cololejeunea calcarea</i>	S
<i>Conocephalum conicum</i>	C, K
<i>Frullania dilatata</i>	C, G
<i>Frullania fragilifolia</i>	A, C, T
<i>Frullania microphylla</i>	C
<i>Frullania tamarisci</i>	C, P, S
<i>Jungermannia atrovirens</i>	C, H, K
<i>Lophocolea heterophylla</i>	M
<i>Metzgeria furcata</i>	A, C, K, P, S, T
<i>Pellia endiviifolia</i>	A, C, K
<i>Plagiochila asplenioides</i>	C, S
<i>Porella arboris-vitae</i>	C, G, P
<i>Porella platyphylla</i>	H, S, M
<i>Preissia quadrata</i>	C, K, S
<i>Riccia sorocarpa</i>	S
<i>Scapania aspera</i>	K
<i>Scapania compacta</i>	T
<i>Scapania gracilis</i>	T
<i>Scapania undulata</i>	P
<i>Tritomaria quinqueidentata</i>	C

Ferns

<i>Asplenium adiantum-nigrum</i>	S
<i>Asplenium trichomanes</i> spp. <i>quadrivalens</i>	B, C, G, H, K, M, P, S, T
<i>Asplenium viride</i>	C
<i>Blechnum spicant</i>	K, P
<i>Cryptogramma crispa</i>	C, P
<i>Cystopteris fragilis</i>	C, K, P, T
<i>Dryopteris filix-mas</i>	A, G, T
<i>Matteuccia struthiopteris</i>	S
<i>Phyllitis scolopendrium</i>	A
<i>Polypodium vulgare</i>	Z

