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THE LICHEN FLORA OF LUNDY: II THE COMMUNITIES

By

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INTRODUCTION

Our previous paper documented 315 lichen taxa for Lundy (James *et al*, 1996). As a result of two further visits to the island in August 1996 and January 1997 this total now stands at 348 taxa (see Appendix for records and notes relating to the additional species).

Lundy is approximately 5.5 km (3.5 miles) in length, north to south, and mostly less than 1.5 km (1 mile) wide. The island is mainly an undulating plateau of hard crystalline granite, rising to 162 metres (525 feet) at Beacon Hill, and edged by steeply descending or precipitous cliffs and buttresses to a much indented shoreline. Access to the shore is difficult except at a few places, eg North West Point, Quarry Beach and Brazen Ward. A few narrow, more basic trachyte and dolerite dykes, more readily weathered, intrude into the granite as at North Light and the Earthquake (Tindle and Thorpe 1991). The main area of sedimentary rock - slate (Pilton shale) - occurs at the south-eastern end of the island including at the Landing Beach, Harbour Hill, below the Castle and Rat and Mouse Islands. This rock type is a relatively unstable, soft and moisture-retaining slate (Tindle and Thorpe 1991; Langham 1994), often with newly exposed, laminated surfaces which are colonised by an interesting pioneering lichen flora.

The northern part of the island, beyond Threequarter Wall, is the least disturbed and consists of sparingly-grazed heathland dominated by *Calluna* with increasing amounts of *Pteridium* (bracken) mostly on a shallow, sometimes incomplete, and accumulating layer of humus over granite. This area appears to have lost much of its humus and plant cover as a result of the fires of 1933 and 1935 (Langham 1991, 1994). *Calluna* and a complex of humus-dependent, binding lichens, chiefly *Cladonia* spp., are seen as an important stage in the regeneration of this interesting community (Wilkins and Debham 1973) providing a rare opportunity to study this recolonisation and succession in detail.

The greatest variety of substrates occurs south of Quarter Wall where calcicole species occur on stone-mortar walls and derelict or inhabited buildings; elsewhere dry stone walls and special sites, such as The Battery and Beacon Hill Cemetery, contribute to the diversity of the lichen flora. The natural slate outcrops also support a partially different lichen flora from the granite and the sheltered valleys above the Landing Beach carry most of the significant planted tree-cover on the island. The southern part of the island is the most subject to moderate levels of eutrophication associated with cattle and sheep farming which has some impact on the lichen flora, especially on walls and tree boles in more exposed situations. The lichen flora of the island indicates that the levels of sulphur dioxide are low, around 30-35 $\mu g/m^{-3}$, most of which may originate from South Wales. The 'pollution' lichen *Lecanora conizaeoides* is very rare on the island usually occurring on dead stems of *Calluna.*

The predominant substrate preferences of Lundy's lichens are as follows: siliceous acid rocks, including outcrops of granite and slate, as well as the quarries, dry-stone walls, buildings and gravestones (157 taxa); associated with mortar-cement (calcicolous communities), chiefly on walls and derelict or inhabited buildings (42 taxa); mainly *Cladonia* spp., associated with humus-rich soils (terricolous communities) and well-rotted wood (41 taxa); and on trees and shrubs (epiphytic communities) (120 taxa).

METHODS

Overall methodology was kept as simple as possible within the limited time available

for fieldwork. Aspect, vertical heights and general features of individual substrates were noted when applicable. Zonation and distribution of supralittoral lichens on siliceous rocky shores follow those described by Fletcher 1973a, 1973b and 1975. Shore exposures were estimated using key seaweed indicators as given in the Ballantine scale (Ballantine 1961). This scale of shore exposure is from Grade 1 (extremely exposed as on island headlands) to Grade 8 (extremely sheltered as in a sea loch). Most species determinations were made in the field aided by standard chemical tests, but critical material was carefully examined in the laboratory and, where necessary, subjected to thin layer chromatography (White and James 1987). Abundance and percentage cover were estimated using a subjective intuitive methodology referring to a five-point scale of frequency within a sampling area of approximately 1 m^2. Reference should be made to the species list of Lundy lichens for details of frequency, substrate preference and habitat (See James *et al.* 1996).

Findings on Lundy lichen communities are arranged as follows:

SILICEOUS ROCK COMMUNITIES

A Marine (Littoral) Fringe and Maritime Communities

B Inland Communities

C Slate Rock Communities

SUCCESSION SEQUENCE ON GRANITE DOMES AND PEAT

CALCICOLOUS COMMUNITIES

BEACON HILL CEMETERY

TERRICOLOUS COMMUNITIES: *Rhododendron* Path

EPHYPHYTIC COMMUNITIES: TREES

A The Epiphytic Lichens, Trees and Summary Table

B Factors Affecting the Distribution of Epiphytic Lichens

SILICEOUS ROCK COMMUNITIES

The lichen communities on the siliceous rocks of Lundy are described following the established nomenclature cited in James *et al,* 1977. Distinctive, often easily recognisable, assemblages are referred to as Associations; interrelated Associations are members of larger groupings called Alliances. The lichen Associations should not be considered as discrete assemblages but as a series of intergrading communities (noda) with (usually) constant key species and at least a few species in common with adjacent Associations.

A Marine (littoral) Fringe and Maritime (supralittoral) Communities

Lichens in marine and maritime communities are mostly salt dependent and are therefore mainly exclusive to these communities. Their zonation reflects complex relationships between climatic, physical and chemical variables. The most important of these are: salt gradient, exposure, aspect (light, temperature, desiccation), rock type and its nutrient status, pH, tolerance to fluctuations in freshwater, texture of rock, and nutrient-enrichment from external sources, eg seabird excreta. The following communities, from seashore landward, are described:

* Verrucarietum maurae Association: upper littoral or littoral fringe black zone
* Caloplacetum marinae Association: mesic lower supralittoral orange zone
* Xanthorion parietinae Alliance: submesic supralittoral yellow zone. (This zone, which indicates more extreme nutrient enrichment, is not always well developed; when present it infiltrates the upper mesic and/or lower xeric zones.)
* Ramalinetum scopularis Association: xeric upper supralittoral grey zone
* Sclerophytetum circumscriptae Association: dry sheltered recesses within the Ramalinetum scopularis

Verrucarietum maurae Association

This wave-splashed zone, dominated by the black crustose lichen *Verrucaria maura*, is best developed on north-facing rock surfaces. The key species, *V. maura,* extends up the supralittoral belt for several metres where shade, freshwater run-off and damp crevices provide suitable conditions. In the lowest part of this community, the uppermost barnacle zone, *V. maura* often occurs with small quantities of *V. halizoa, V. mucosa and V. striatula. Pyrenocollema halodytes* and the closely related *P. sublitorale* are ubiquitous on barnacles and limpet shells; *P. elegans* and *P. orustense* occur on the vertical north-facing rock at the landing at North West Point. *Lichina pygmaea* seems to be rare on the island but its habitats are often inaccessible; the related species *L. confinis* marks the upper limit of the Association as at Brazen Ward. This Association probably surrounds the entire island, although extensive stretches of shoreline are difficult to reach.

Caloplacetum marinae Association

The indicator species of this orange zone are *Caloplaca marina,* best developed on most exposed and south-facing aspects, *C. thallincola* (nowhere common), *C. microthallina,* which is always associated with *Verrucaria maura* in more sheltered situations, and *Lichina confinis*. Surprisingly, the usually common *Lecanora actophila* is only sparingly present in sunnier sites on Lundy and is largely replaced by *L. helicopis*, often in association with *Catillaria chalybeia,* especially on the eastern side of the island. Shaded, moist, north-facing rocks and associated soil in crevices support *Solenopsora vulturiensis* and *Micarea prasina* as well as the rare *Toninia mesoidea* (North Lighthouse Quay) and *T. aromatica.* Where the rock surfaces in this zone are more eutrophicated with bird droppings, as at Brazen Ward, *Caloplaca verruculifera, Lecania aipospila* and *Phaeophyscia orbicularis* are predominant, with *Aspicilia leprosescens* (commonly found fertile on the island), *Lecanora poliophaea* and *Physcia tenella* ('subsp *marina*') as accessory species. The additional presence of *Xanthoria parietina* in this upper part of the Caloplacetum marinae Association indicates a more nutrient-enriched maritime community, the Xanthorion parietinae Alliance. The abundance of *Xanthoria parietina* on horizontal surfaces and boulder tops above North Lighthouse Quay suggests the presence of a similar community including many of those species indicative of higher levels of eutrophication.

Ramalinetum scopularis Association

The *Ramalinetum scopularis* Association is spectacularly predominant and highly variable on cliffs and butresses, especially on the exposed western side of the island. The overall key species is *Ramalina siliquosa*, which is often very abundant on vertical faces, becoming replaced by or intermingled with *R. cuspidata* at lower levels where it merges into the Caloplacetum marinae Association. Frequent associated species of these very exposed sites include: *Anaptychia runcinata, Buellia aethalea* (mostly on slate), *Lecanora gangaleoides, Lecidella asema* (mostly on slate), *Ochrolechia androgyna, O. parella, Ramalina subfarinacea, Rhizocarpon geographicum* (mostly on slate), *R. richardii, Rinodina atrocinerea, Tephromela atra* and *Verrucaria fusconigrescens,* while the following species are of more local and limited presence in the community: *Buellia punctata, B. subdisciformis, Fuscidea cyathoides, Hypogymnia physodes, H. tubulosa, Lecanora orosthea, L. rupicola, L. sulphurea, Parmelia caperata, P. glabratula* subsp. *fuliginosa, P. saxatilis, P. sulcata, Pertusaria amara, P. pseudocorallina* and *Sphaerophorus globosus.* Rare species include: *Anaptychia ciliaris* subsp. *mamillata, Aspicilia epiglypta, Buellia ocellata* (mostly on slate), *B. stellulata* (mostly on slate), *Caloplaca crenularia, Diploschistes caesioplumbeus* (mostly on slate), *Lecanora polytropa* (mostly on slate), *Lecidella prasinula, Pertusaria flavicans, Porpidia cinereoatra, P. platycarpoides, Rinodina confragosa* (on slate) and *R. luridescens* (only on granite). Species of *Parmelia (P. conspersa, P. loxodes, P. perlata, P. pulla, P. reticulata, P. verruculifera)* are often present within or at the landward edge of this association.

On vertical, west-facing outcrops there are mosaics of *Buellia subdisciformis* with, towards the landward edge, *Fuscidea cyathoides* and *Lecanora gangaleoides*; the rare *Lecanora praepostera* occurs in this community north of Tibbett's Point.

The lichens of the more sheltered and shaded aspects within this association are very diverse; low down on the bluffs of the western side and also at the northeast of the island there are extensive patches of *Rinodina beccariana* (= *R. subglaucescens*), with *Diploicia canescens* and the easily overlooked, often sterile, *Lecanora tenera.* A drier component of this community, the Sclerophytetum circumscriptae Association (James 1970), which is surprisingly poorly developed on the island, is present on the north side of Tibbett's Point and includes *Chiodecton myrticola* (sterile), *Dirina massiliensis* f. *sorediata* and *Sclerophyton circumscriptum*; occasionally, *Roccella phycopsis* in small sheltered crevices enters this association on the west side of the island.

A distinctive and specialised terricolous/corticolous/lignicolous lichen community associated with dead *Armeria* tussocks occurs within the Ramalinetum scopularis Association. This was examined at the Northwest Point (Virgin's Spring region) and above Northeast Point where the east-facing slope near the bridge to the North Lighthouse supports a rich growth of *Armeria.* Especially common on these mounds are: *Anaptychia runcinata, Cladonia cervicornis, C. ramulosa*, with smaller amounts of *Lecanora expallens, Lepraria incana, Micaria prasina, Ochrolechia androgyna, Parmelia sulcata* and *Rinodina roboris* (rare); *Ramalina siliquosa* and *R. subfarinacea* are widely dispersed throughout. *Cladonia* species locally abundant on the numerous dead tufts include *C. chlorophaea, C. furcata, C. foliacea* and *C. polydactyla*; *C. floerkeana* and *C. rangiformis* are rare.

Selected shores

a) Landing Beach

This site, a laminated slate shore (exposure Grade 6), is sheltered from the prevailing south-west wind and shaded much of the time being north- and east-facing and is more moisture retentive than equivalent granite shores. The fragile, crumbling slate rock, which is constantly naturally eroding, comes under further stress from pedestrian and vehicular traffic. Overall, the two communities (in the black and orange zones) are very narrow (each only about 1m in vertical height), although with the impact of increasing salt spray they tend to extend landwards onto the more open vertical sea-facing rocks higher up the coast road where the hewn rocks of the roadside walls are particularly interesting. *Verrucaria maura* forms a distinct zone, extending upwards in damp cracks and runnels. Nowhere here is *Caloplaca marina* well developed due to its intolerance of the more shaded, moisture-retaining conditions. Other species in this community include *Caloplaca microthallina, C. thallincola* (not common), *Catillaria chalybeia, Diplotomma alboatrum, D. chlorophaeum, Lecania atrynoides, L. erysibe, L. turicensis, Lecanora actophila, L. cenisia* var. *atrynea, L. dispersa, L. helicopis, Lichina confinis, Ochrolechia parella, Opegrapha conferta, Ramalina siliquosa, Tephromela atra* (some large colonies), *Toninia aromatica, Verrucaria prominula* and *Xanthoria parietina.* Apart from *Opegrapha conferta,* common on the moist surfaces and ends of broken bedded slate, none of these species is particularly frequent. Some are more characteristic of the Ramalinetum scopularis Association above and are thinly distributed in this frequently disturbed, compacted and rather poorly colonised orange zone.

b) Brazen Ward (See Fig. 1)

This very interesting site is dominated by an east-facing, granite tongue projecting laterally into the sea with a very sheltered, steep, north-facing side protected by the bay, the whole shore being moderately to very sheltered (exposure Grade 6). The tip (b) and south side of the tongue are more open and exposed, with the sloping, shelved south side receiving sun on its south- and west-facing vertical surfaces. Moreover the tongue itself has a central dome (d) which is more elevated than the surrounding rock. This dome and the long horizontal extension give an erroneous impression of a large area of black and orange zones, but these are merely stretched outwards, and collectively in vertical height do not reach more than 3m in any one place on the tongue. However, this large horizontal extension out to sea provides much surface for the development of a flourishing maritime community subject to salt spray from various directions and considerable nutrient enrichment from bird droppings.

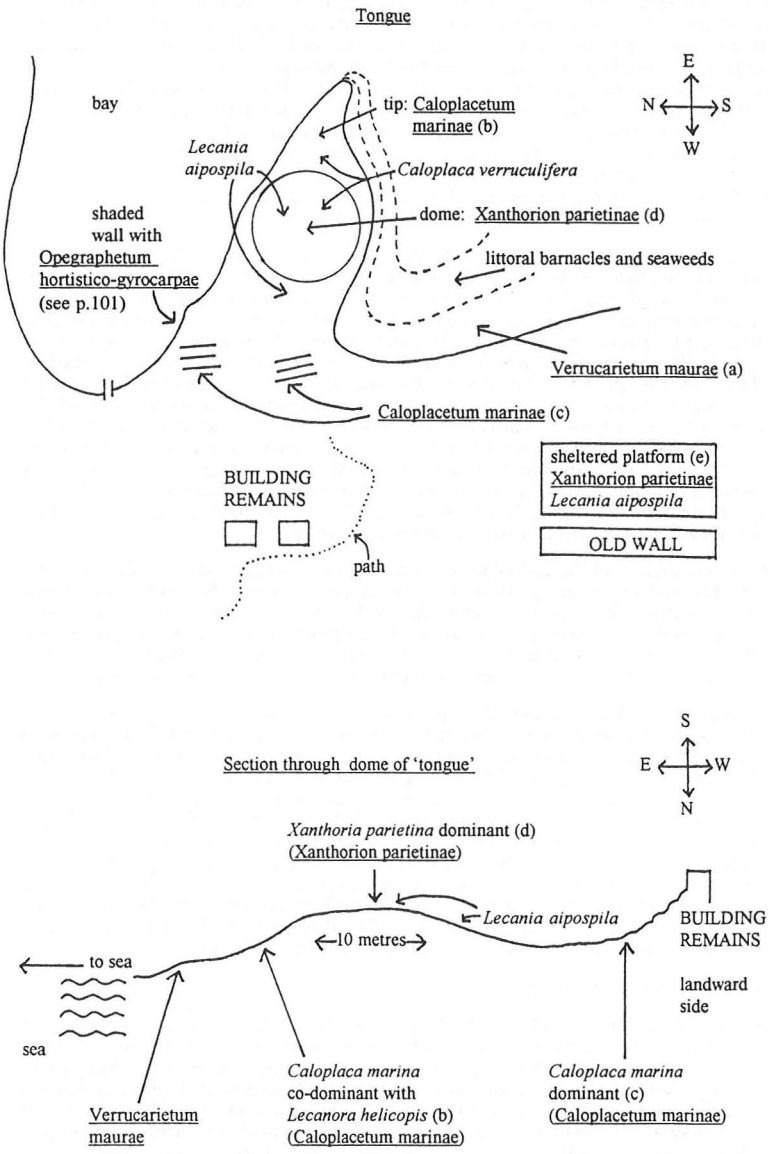


Figure 1: Brazen Ward: Zonation of Supralittoral Lichen Communities

The Verrucarietum maurae Association, which extends vertically from the sea for up to 2m, is also well developed around the tongue, especially on the south side where waves lap and splash higher on the more sloping lower rock platform (a). (*Verrucaria halizoa, V. mucosa, V. striatula* and *Pyrenocollema elegans* are generally lower down in the littoral zone and are associated with the seaweeds *Pelvetia canaliculata* and *Catanella* sp. coinciding with the upper limits of barnacle colonisation). *Verrucaria maura* continues to fill declivities and cracks in horizontal rock up through the mesic (orange) zone (pH of crevice soil 6.5) and into the grey zone above (pH of crevice soil below 4.5). The surface of the tip of the tongue (b) has a Caloplacetum marinae Association with *C. marina* co-dominant with *Lecanora helicopis* on the flat tops, *V. maura* in the crevices, and some *Caloplaca verruculifera, Lecania aipospila* and *Xanthoria parietina* on the damper sides of the blocks of rock where surface moisture is retained longer and nutrient-enrichment more concentrated.

On the landward side of the dome there is a second well developed orange Caloplacetum marinae Association (c) with *C. marina* on the sunnier edges of the stepped south-west-facing rock and vertical sides of west-facing blocks. Included in this diverse community are: *Diploicia canescens, Diplotomma alboatrum, Halecania ralfsii, Lecanora gangaleoides, L. helicopis, Lecidella asema, L. scabra, Lichina confinis* (little), *Ochrolechia parella, Parmelia delisei, P. pulla, Physcia adscendens, Ramalina cuspidata, Rinodina gennarii, Xanthoria parietina,* with *Lecania aipospila* in the damp gullies. *Aspicilia leprosescens* and *Tephromela atra* (sparse) occur on the tops of the ridges receiving extra nutrient enrichment. *Lecanora helicopis* is an important member of the Caloplacetum marinae Association here, but is not as abundant as at the tip of the tongue (b). *Lecanora actophila* is scarce, restricted to a few better lit, south-facing vertical-sided boulders. On sunny outcrops, *Caloplaca marina* is scattered even further, among members of the higher Ramalinetum scopularis Association, these latter often showing a preference for at least some nutrient enrichment.

Some of the species of the Caloplacetum marinae are also found more landward where a damp, sheltered horizontal platform (e) (pH of crevice soil 6.0) supports an almost complete coverage of *Lecania aipospila* with *Aspicilia leprosescens, Lecanora poliophaea* (rare) and *Verrucaria prominula.* In the most sheltered aspects *Solenopsora vulturiensis, Micarea prasina* and *Lecania baeomma* occur on friable rock or soil, all of which are indicator species of low level nutrient enrichment from nearby seepage tracks.

The upper part of the dome (d), rising up to 2m above these two *Caloplaca* communities, is one of the most distinctive features at Brazen Ward. It represents a Xanthorion parietinae Alliance but supports a very unusual community, dominated overall by *Lecania aipospila* and *Xanthoria parietina* with scattered islets of *Verrucaria maura* chiefly confined to cracks. Extensive patches of *Lecania aipospila* have *Caloplaca verruculifera* at their margins interspersed with tiny islands of *Phaeophyscia orbicularis* and some colonies (often in tiny depressions) of *Rinodina orculariopsis.* These are the key species of this interesting community which is influenced by a combination of factors including aspect, marked increase in nutrient status due to bird droppings, frequent salt spray and in wet weather periodic soaking with freshwater from rain. *L. aipospila* further extends down the landward slope from the dome where it is associated with scattered *Ramalina siliquosa* rather than *X. parietina.*

c) North Lighthouse Quay (See Fig. 2)

This near-vertical and exposed supralittoral site (exposure Grade 2-3), accessible by a series of steps to the quay, is mostly north-facing with rock outcrops and boulders subjected to some nutrient enrichment where some outcrops are bird perching rocks (Fig. 2). The *Verrucaria* and *Caloplaca* zones and transitional *Xanthoria*-dominated zone are all extended upwards to a vertical height of about 30m under the influence of wave and spray effects. While granite predominates, there is also a narrow, softer dyke of trachyte (more water-retentive and of different, more basic mineral composition) which, due to erosion, often lies in depressions and therefore is often more shaded and sheltered. The pH of the crevice soil is approximately 6.0 throughout the 30m, but once clearly in the Ramalinetum scopularis Association, as at the bridge at about50 m, the pH value falls below 4.5.

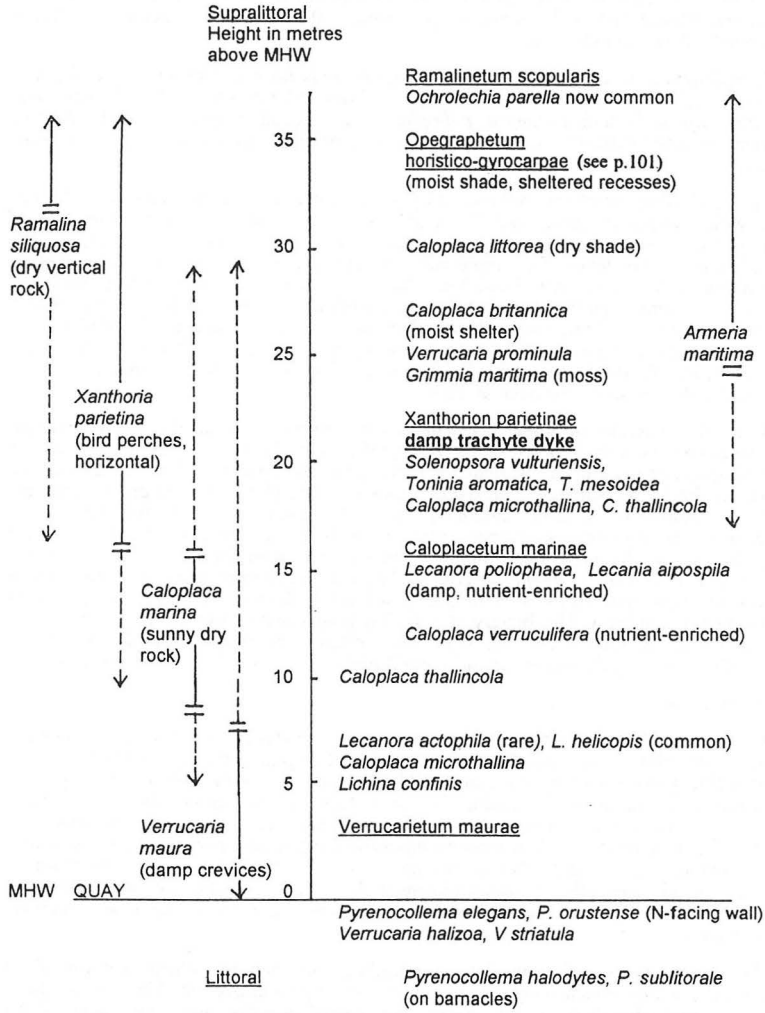


Figure 2: North Lighthouse Quay: Lichen Zonation, North-facing, +/- Vertical Rock

The Verrucarietum maurae is well developed for approximately 8m and extends upwards locally in crevices and sheltered aspects for many metres further. *V. maura* almost entirely covers the vertical faces of the rock at this level but is, here and there, mixed with small amounts of *Caloplaca marina*, *C. microthallina, Lecanora helicopis* and *Lichina confinis* on horizontal rock surfaces. Just below in the barnacle zone (upper littoral) are *Pyrenocollema halodytes* and *P. sublittorale* on barnacles, *P. elegans* and *P. orustense* on a north-facing wall of the landing stage and *Verrucaria halizoa* and *V. striatula* on adjacent rock surfaces. Near the upper limit of the *Verrucaria maura* zone, in shelter and shade, are very small amounts of *Caloplaca thallincola, C. verruculifera, Lecanora poliophaea* and *Xanthoria parietina*, the last three species indicating enhanced nutrient enrichment.

The Caloplacetum marinae mesic community extends for a further 8m, but *Caloplaca marina* is chiefly confined to drier, sunnier, well-drained extremities of rock exposures. *Lecania aipospila* and *Lecanora poliophaea* are indicator species of the damper nutrient-enriched surfaces. Not unexpectedly on a north-facing site *Lecanora actophila* is rare.

The Xanthorion parietinae, influenced by sea bird perches, extends upwards a further 18m with *Caloplaca marina* and *Verrucaria maura* still present in the community in appropriate places. *Armeria maritima* is anchored in crevices and becoming well established at this level. This represents the lower edge of the grey Ramalinetum scopularis Association, with *Ramalina siliquosa* restricted to drier vertical surfaces. There are several significant microhabitats, including the trachyte dyke intrusion and mortar and cement, of and alongside the often damp steps. *Caloplaca microthallina* and *Xanthoria parietina* are particularly well developed on the dyke substrate, even at this elevation, and *C. thallincola,* with *Solenopsora vulturiensis, Toninia aromatica* and *T. mesoidea,* also occur on the dyke at 22m.

Where the tussocks of *Armeria maritima* are common at 25m, the soil component increases considerably between outcrops. Significant in this community, the lowermost Ramalinetum scopularis, is *Caloplaca britannica* on sheltered rock beneath the painted metal handrail. The isidiate *C. littorea* becomes widespread in sheltered dry underhangs, while in somewhat moister underhangs a shade community corresponding to the Opegraphetum horistico-gyrocarpae Association is present which includes *Bacidia scopulicola, Buellia punctata, Caloplaca littorea, C. verruculifera, Lecanora tenera, Opegrapha cesareensis, Ramalina canariensis, Scoliciosporum umbrinum* and *Tonina mesoidea.* This community at 35m above sea level closely resembles the very well developed examples at The Battery at a similar height and at Brazen Ward only about 3m above mean high water (MHW). This confirms the importance of exposure in vertically extending the lichens in the supralittoral zone (See Allen and Hilton 1987).

d) The Battery

Access to the lowest west-facing granite rocks at The Battery is difficult. However, at about 35m above the sea the presence of a *Caloplaca* mesic community on a west-facing granite wall by the main buildings again shows the role of the degree of exposure in elevating and widening this zone. Here at The Battery the rock is much sunnier, warmer and drier than at the North Lighthouse Quay and there is an abundance of *Lecanora actophila* with frequent *Caloplaca marina* and *Lecanora helicopis* with some *Anaptychia runcinata*; *Verrucaria maura* is in the damp cracks. The pH of soil in this wall is alkaline (pH 7.2) which illustrates the influence of the salt spray associated with the development of the mesic supralittoral community, the Caloplacetum marinae Association.

The Battery ruins and immediate surroundings are rich in lichens and provide a complexity within which several communities converge and overlap. These associations are discussed elsewhere in this paper, but special mention must be made of the interesting example of the Opegraphetum horistico-gyrocarpae Association found on a low, very sheltered, damp, hewn, north-facing vertical granite rock face in a narrow alley at the side of the buildings, as well as the occurrence there of two uncommon species of *Ramalina, R. lacera* and *R. portuensis.*

B Inland Communities

On the more exposed western side of the island the Ramalinetum scopularis penetrates inland much further than on the eastern side (more sheltered from prevailing winds) where it is more narrow, closer to the shoreline and less well-defined. While there is a maritime influence (salt-laden winds) generally over all of Lundy extending the distribution of many salt-tolerant (halophilic) species, areas of shelter, especially on the eastern side, contribute to the infiltration of a number of salt-intolerant (halophobic) species. This leads to the occurrence of communities which, apart from the inclusion of some halophilic species, might be found elsewhere in Britain, albeit often adjacent to coastal areas of southwest England.

Shade associations

* Lecideetum orostheae Association
* Opegraphetum horistico-gyrocarpae Association

Parmelion conspersae Alliance (Nutrient-enrichment)

* Candelarielletum corallizae Association
* Parmelietum glomelliferae Association

Parmelion perlatae Alliance

* Parmelietum revolutae Association
* Teloschistetum flavicantis Association

Exposed association

* Parmelietum omphalodis Association

Shade associations

Lecideetum orostheae Association

Dry, but relatively well-lit, recesses support extensive patches of *Haematomma ochroleucum* var. *porphyrium* (sometimes fertile) with *Lecanora gangaleoides* (often in an emaciated, ecologically stressed, condition), *L. orosthea, Lepraria incana, Leproloma membranceum and Psilolechia lucida;* their assemblage corresponds to the Lecideetum orostheae Association, and also includes on Lundy the very rare *Ramalina pollinaria,* probably more frequent here than at any of its few other stations in Britain.

Opegraphetum horistico-gyrocarpae Association

In sheltered, more moisture-retentive recesses, elements of the association Opegraphetum horistico-gyrocarpae Association are found, including *Bacidia scopulicola, Catillaria chalybeia, Lecania baeomma, Lepraria incana, Leprocaulon microscopicum, Opegrapha caesareensis, O. conferta, O. multipuncta, Scoliciosporum umbrinum, Solenopsora vulturiensis* and *Verrucaria maura.* However, the key species *Enterographa zonata* and *Opegrapha gyrocarpa,* are very rare on the island. The Lundy representatives of the Association are found at North West Point, Brazen Ward and are particularly well developed on a shaded rock cutting by the ruins at The Battery. A fragmentary example of this Association, containing *Enterographa zonata* with *Lecanora tenera* (as fertile and sorediate ecotypes), *Haematomma ochroleucum* var. *porphyrium, Lecania baeomma* and *Porpidia platycarpoides,* occurs on a sheltered, rather damp, north-facing wall in Quarry C. The only other recorded occurrence of *Enterographa zonata* is on the south-east-facing shaded slate wall of the calor gas storehouse by the harbour roadside (near Millcombe House) where it occurs with *Opegrapha gyrocarpa* and includes the following additional species: *Caloplaca citrina, Diplotomma alboatrum, D. chlorophaeum, Dirina massiliensis* f. *sorediata, Lecanora gangaleoides, Lepraria incana, Leproloma membranaceum, Ochrolechia parella, Opegrapha conferta, O. saxatilis, Polysporina simplex, Porina chlorotica, Rhizocarpon concentricum* and *R. obscuratum.*

Parmelion conspersae Alliance

The Parmelion conspersae Alliance comprises associations on well-illuminated, slightly to markedly nutrient-enriched siliceous rocks. It is well represented and diverse over much of the plateau granite outcrops, especially those north of Quarter Wall and

intergrades at the cliff edges, often imperceptibly, into the Ramalinetum scopularis Association. The two major associations of this Alliance relevant to Lundy are the nutrient-rich Candelarielletum corallizae, which is local, and the Parmelietum glomelliferae, which is predominant on rocks over most of the central area of the island. A further Association, the Lecanoretum sordidae, predominantly of crustose species, is weakly represented on more nutrient-enriched slate rock, but is here, however, insufficiently distinct from the Parmelietum glomelliferae to warrant separate status.

Candelarielletum corallizae Association

The Candelarielletum corallizae Association is characteristic of nutrient-enriched sites, especially bird-perching rocks. Away from the coast such sites are relatively limited on Lundy and this special community is probably best observed on the granite marker stones at the sides of the main track to the North End and, more rarely, nutrient-enriched stones on walls. The marker stones average approximately m in height and their summits are frequently used as territorial markers by birds. The composition of the lichen flora on these stones does not indicate such extreme eutrophication as occurs on similar sites on Skomer (Wolseley *et al.* 1996), but nevertheless a proportion of them support key species of the Association: *Aspicilia leprosescens, Buellia punctata, Candelariella vitellina, Physcia adscendens, P. tenella, Rinodina gennarii, Xanthoria candelaria and X. parietina*; *Buellia coniops* and *Rinodina orculariopsis* are noteworthy rarities in this community.

Parmelietum glomelliferae Association

The Parmelietum glomelliferae Association is common, very diverse and widely distributed on acid rock on all western coasts of Britain and is indicated on Lundy by the presence of four key brown *Parmelia* spp. *P. delisei* (rare), *P. loxodes, P. pulla and P. verruculifera.* Additional *Parmelia* spp entering this widespread Association on Lundy are *P. britannica* (rare), *P. caperata, P. conspersa, P. glabratula* subsp. *fuliginosa, P. perlata, P. reticulata, P. saxatilis* and *P. sulcata. Hypogymnia physodes, H. tubulosa* and *Sphaerophorus globosus* are also sparingly represented. The common crustose species in the association on Lundy are: *Buellia aethalea* (mostly on slate), *Caloplaca crenularia, Candelariella vitellina, Fuscidea cyathoides, Lecanora gangaleoides, L. polytropa* (mostly on slate), *L. rupicola, Lecidella scabra* (mostly on slate), *Ochrolechia androgyna, O. parella, Pertusaria pseudocorallina, Rhizocarpon geographicum* (mostly on slate), *Rinodina atrocinerera, Tephromela atra* and *Trapelia obtegens.* Certain salt-tolerant (halophilic) supralittoral species more characteristic of the Ramalinetum scopularis Association may also be sparingly present: *Aspicilia leprosescens* (requires bird-droppings), *Lecanora fugiens* (rare), *Lecidella asema* (mostly on slate), *Porpidia platycarpoides* and *Rhizocarpon richardii. Ramalina siliquosa* remains abundant on rock faces in more exposed aspects facing the sea. Less frequent or very rare species include: *Buellia ocellata* (above Landing Beach), *Lecidea diducens, L. fuscoatra* (on slate), *L. lactea* (on slate), *Pertusaria amara, P. corallina, P. flavicans* and *Sarcogyne privigna* (James *et al.* 1996 for localities).

Parmelion perlatae Alliance

Because of the general elevation of the island towards the western coast, the eastern side is mostly protected from the prevailing westerly winds as well as from the sun, especially in winter. During the summer much of the east side shoulder, north of Halfway Wall, is densely covered in a lush growth of *Pteridium* which provides additional moisture-retaining shade and shelter for lichens, particularly at the bases of the bluffs and low scree boulders as, for instance, at Tibbett's Point and above Gannets' Bay. These conditions favour the development of the saxicolous version of the Parmelietum revolutae Association which, together with the Teloschistetum flavicantis Association on the west, are the two associations of the Parmelion perlatae Alliance on the island. Most species included show some degree of salt-tolerance.

Parmelietum revolutae Association

The predominant *Parmelia* spp. are *P. caperata, P. glabratula* subsp. *fuliginosa, P. perlata, P. reticulata, P. saxatilis* and *P. sulcata* - more rarely, *P. britannica* and *P.*

omphalodes. Buellia aethalea (mostly on slate), *B. subdisciformis, Fuscidea cyathoides, Lecanora gangaleoides, L. rupicola, L. sulphurea, Ochrolechia androgyna, O. parella, Pertusaria pseudocorallina, Porpidia cinereoatra, Rhizocarpon geographicum* (mostly on slate), *Rinodina atrocinerea, Tephromela atra, Trapelia involuta* and *T. obtegens* are the predominant crustose species; *Lepraria caesioalba, Parmelia endochlora, P. laevigata, Usnea cornuta* and *U. flammea* are significant and important rarities on outcrops and boulders on the eastern side. *Ramalina siliquosa, R. subfarinacea* and *Rhizocarpon richardii* infiltrate from the upper limit of the more seaward Ramalinetum scopularis Association.

Teloschistetum flavicantis Association

According to Gilbert (1995) and Gilbert and Purvis (1996), *Teloschistes flavicans* is probably more abundant on the west coast of Lundy (the species is entirely absent from the eastern side) than elsewhere in the British Isles with, perhaps, the exception of the Isles of Scilly. A species which has seriously declined in distribution in Britain this century due to air pollution, eutrophication and destruction of its inland habitats, it is now considered an endangered species cited as vulnerable in the JNCC *Red Data Book for Lichens* (Church *et al.* 1997) and is listed in Schedule 8 of the Wildlife and Countryside Act, 1981.

On coastal sites in Lundy the Teloschistetum flavicantis community appears to occupy a position midway between the Ramalinetum scopularis and the Parmelietum glomelliferae and is present in both. On inland sites in Britain it forms a distinct component of the Parmelietum revolutae Association. The species is concentrated in very windy, exposed situations, either wind funnel areas up cliff faces or very exposed, west-facing rock faces or bluffs. Generally thalli are anchored to rock substrates by *Parmelia* spp. such as *P. perlata* and *P. sulcata* as well as the liverwort *Frullania,* or entangled around *Ramalina* spp. On soil, *T. flavicans* is anchored by *Cladonia ciliata* var. *tenuis, Calluna vulgaris, Festuca ovina* haulms, or dead tufts of *Armeria maritima* or sometimes bare peat. *Ramalina portuensis* and *Nephroma laevigatum* (only record) occur with *T. flavicans* in this community at The Battery. The compositions of the Teloschistetum flavicantis community on rock (saxicolous) and on soil (terricolous) are given in the following lists compiled from a sampling survey at three sites on the west of Lundy.

Five saxicolous plants and five terricolous plants were studied in 20 x 20 cm quadrats respectively. In each quadrat the percentage cover of each lichen species and phanerogam was recorded. The results of the five quadrats were then totalled and a mean percentage cover was obtained for each lichen species and the phanerogams for the community associated with a) the saxicolous *T. flavicans* and b) the terricolous *T. flavicans.*

Mean percentage cover: Saxicolous *Teloschistes flavicans*

T. flavicans	14	**PHANEROGAMS**	
Parmelia sulcata	18		
P. saxatilis	11	*Sedum anglicum*	5
Ochrolechia parella	7	*Erica cinerea*	1
Anaptychia runcinata	6	*Carex arenaria*	+
Ramalina subfarinacea	6		
R. siliquosa	4	**Bare soil/peat/rock**	6
Parmelia perlata	4		
P. reticulata	4		
Pertusaria pseudocorallina	3		
Fuscidea cyathoides	3		
Ochrolechia androgyna	3		
Buellia punctata	2		
Lecanora gangaleoides	2		
Rhizocarpon richardii	1		
Usnea flammea	1		
Ramalina cuspidata	1		
R. farinacea	+		

Mean percentage cover: Terricolous *Teloschistes flavicans*

T. flavicans	18	**PHANEROGAMS**	
Parmelia saxatilis	10		
Cladonia ciliata var tenuis	8	*Armeria maritima*	12
C. subcervicornis	6	*Calluna vulgaris*	8
Ochrolechia parella	6	*Erica cinerea*	4
Parmelia sulcata	5	*Sedum anglicum*	2
Rhizocarpon richardii	4	*Festuca ovina*	2
Usnea flammea	3	*Thymus polytrichus*	1
Parmelia perlata	2	*Carex arenaria*	+
Peltigera lactucifolia	2	*Pteridium aquifolium*	+
Cladonia furcata	1		
Nephroma laevigata	1	**Bare soil/peat/rock**	9
Hypogymnia physodes	1		
Ramalina subfarinacea	+		

Exposed association

Parmelietum omphalodis Association

On the western side of the island between Quarterwall and Halfway Wall there is an area of acid heathland (pH of soil in rock crevices less than 4.5) with wind-exposed low granite domes. (See the following section, p. 106 on the succession and development of these domes.) The domes are dominated by a rich growth of *Parmelia omphalodes*, together with other foliose and crustose species and a number of *Cladonia* spp. The species include: *Anaptychia runcinata, Fuscidea cyathoides, Hypogymnia physodes, Lithographa tesserata* var. *petraea, Ochrolechia androgyna, O. parella, Parmelia saxatilis, P. sulcata, Pertusaria pseudocorallina, Porpidia platycarpoides, Ramalina siliquosa, R. cuspidata, R. subfarinacea* and *Rinodina atrocinerea.* Associated with soil in the cracks and depressions or on the peat/granite edges are: *Cladonia chlorophaea, C. ciliata* var. *tenuis* (at dome edges), *C. diversa, C. firma, C. floerkeana, C. furcata* (abundant in the soil inclusions in cracks), *C. polydactyla, C. subcervicornis, C. uncialis* and *Sphaerophorus globosus.*

An unusual example of the Parmelietum omphalodis Association occurs in Quarry C (Harman Memorial Quarry) on an almost vertical, very sheltered, damp north-facing

granite wall, about 15m^2. Although *Parmelia omphalodes* is absent, probably due to the lack of suitable horizontal surfaces, other members of this association are well represented: *Parmelia saxatilis* (fertile), *Platysmatia glauca* and *Usnea flammea* (both common) with occasional *Fuscidea cyathoides, Ochrolechia androgyna, Parmelia sulcata* and *Sphaerophorus globosus.* Nowhere else on Lundy is such a community encountered and, apart from other quarry walls (also north-facing), records for *Platysmatia glauca* are very few. This community also includes small amounts of *Cladonia ramulosa, Haematomma ochroleucum* var. *porphyrium, Hypogymnia physodes, H. tubulosa, Parmelia glabratula* subsp. *fuliginosa, Pertusaria pseudocorallina, Porpidia platycarpoides, P. tuberculosa* and *Rinodina atrocinerea.* It is probable that this rock face is poor in nutrients due to continuous leaching from an overarching, humus-rich *Calluna* community on the cliff ledges above. Other areas of the quarries represent the Ramalinetum scopularis on granite, at any one place remaining rather poor in species, but with an abundance of *Fuscidea cyathoides, Porpidia platycarpoides* and *P. tuberculosa. Cladonia ramulosa* and *Peltigera* spp. are also frequent, being particularly characteristic of the disturbed soil, a feature of the floor of the quarries.

C Slate Rock Communities

The slate outcrops at the southern end of the island are of a much softer, friable rock and are frequently subject to landslips and fragmentation which expose new surfaces for colonisation. The lamelliform structure of the rock results, especially when tilted end on, in a more moisture-retaining substrate richer in available minerals and nutrients than granite surfaces. The smoothness of these newly exposed, temporary surfaces favours the successful colonisation of a wide range of pioneering crustose species.

Although many lichens are common to both granite and slate on the island - eg those of the Ramalinetum scopularis and the Parmelietum glomelliferae - there is a noteworthy number of taxa which are exclusive to, or predominantly favour, slate. These include: *Acarospora impressula, Baeomyces rufus, Buellia ocellata, B. saxorum, B. stellulata, Caloplaca ceracea, Diploschistes muscorum* (on *Cladonia), Enterographa crassa* (saxicolous), *Lecania atrynea, L. hutchinsiae, Lecanora cenisea* var. *atrynea, Lecidea fuscoatra, L. lactea, Opegrapha lithygra* (walls), *Porina chlorotica* (underhangs), *Rinodina confragosa* and *Trapeliopsis wallrothii* (crevice soil). Other species which are more frequent on slate than granite surfaces on Lundy are: *Acarospora smaragdula, Aspicilia epiglypta, Buellia aethalea, Catillaria chalybeia, Diploschistes caesioplumbeus, Lecania atrynoides, Lecanora polytropa, Lecidella asema, Lecidella scabra,* and *Rhizocarpon geographicum.*

A few species are particularly characteristic of cemented slate walls - *Collema tenax, Diplotomma chlorophaeum, Lecidella stigmatea, Opegrapha saxatilis* (*O. chevallieri* ecotype) and *Rhizocarpon concentricum,* preferring to grow on the harder slate rock than the adjacent calcareous cement.

The best developed Opegraphetum horistico-gyrocarpae Association (p. 101) occurs on slate on the south-east-facing wall of the calor gas storehouse by the harbour road, near Millcombe House.

The most permanent lichen communities on slate occur immediately below the Castle where trachyte and dolerite dykes intrude into the slate on the east side of the foundations of the building; the lichens include: *Anaptychia runcinata, Buellia aethalea, Caloplaca ceracea, C. crenularia, Candelariella vitellina, Diploschistes caesioplumbeus, Lecanora campestris, L. gangaleoides, Lecidella scabra, Ochrolechia parella, Parmelia verruculifera, Pertusaria pseudocorallina, Physcia adscendens, Ramalina siliquosa, R. subfarinacea, Rhizocarpon richardii, Rinodina confragosa, Tephromela atra and Xanthoria parietina.*

Nevertheless, the slate rock below the Castle characteristically fractures into loose slithers which develop their own diagnostic pioneer lichen flora including: *Acarospora smaragdula, Buellia punctata, Caloplaca holocarpa, Catillaria chalybeia, Lecania erysibe, L. rabenhorstii, L. dispersa* agg., *L. fugiens, Rinodina gennarii, Scoliciosporum umbrinum, Verrucaria fusconigrescens* and *V. internigrescens.*

Longer established surfaces (10-20 years) lose many of the pioneer species which are overgrown by more aggressive species characteristic of the permanent communities. Similar succession involving different species are known on freshly cut rock surfaces, such as granite and rough marble gravestones in churchyards and on recently exposed surfaces of talc, on the serpentines of the Keen of Hamar, Unst, Shetland (See Gilbert and James 1987).

SUCCESSION SEQUENCE ON GRANITE DOMES AND PEAT (See Fig. 3)

The northern half of Lundy provides a unique opportunity to study the role of lichens in the relatively undisturbed reestablishment of consolidated humus spreading over a series of low granite domes. This sequence ranges from 1) a very thin, often interrupted humus cover such as occurs at the extreme north of the island through 2) intermediate stages with deeper and more extensive humus to 3) the final luxuriant *Calluna* heathland immediately north and northwest of Pondsbury. This succession mainly involves the Parmelietum glomelliferae on rock and a *Cladonia*-moss-hepatic community on humus derived from small, often temporary, *Calluna vulgaris* plants on the small pockets of humus developing between the granite domes. The lichen flora plays a significant role in assisting the stabilisation of the dead detritus from these often environmentally stressed *Calluna* plants. The resulting slow accumulation of humus by the cryptogams thus goes towards the enlarging and deepening of the humus on which the more diverse phanerogamic community can subsequently develop.

1) On the northernmost part of the island plateau, especially above North West Point, the granite is conspicuous as low, exposed domes associated with a fragile, very thin (1-2 cm deep) surrounding humus accumulation. These domes and the intervening humus were probably exposed as a result of the loss of humus cover in the fires of 1933 and/or 1935. The North End fire of 1933 burned for 52 days and covered an area of 67.5 acres (Langham 1991). The extensive bared areas of granite have undulating surfaces of shallow, often interconnected depressions and slightly raised ridges (to 3 cm high). A characteristic, often sparse, lichen flora occurs directly on this granite, including *Parmelia conspersa* in the shallower depressions indicating a higher concentration of nutrients in these run-off channels. The bases of the deepest depressions are often without lichens except for the poorly understood species *Lithographa tesserata* var. *petraea* which has gnarled clusters of fruits (but practically no visible thallus) amongst the coarse granite crystals. *Pertusaria pseudocorallina* and *Rinodina atrocinerea* predominate on the sides of the depressions with *Ochrolechia parella, Parmelia loxodes* and *P. verrucilifera* on the rims. The summits of the ridges have thinly dispersed thalli of *Ramalina siliquosa* and a small scattering of such species as *Lecanora gangaleoides, L. rupicola, Parmelia saxatilis* and *Porpidia platycarpoides.*

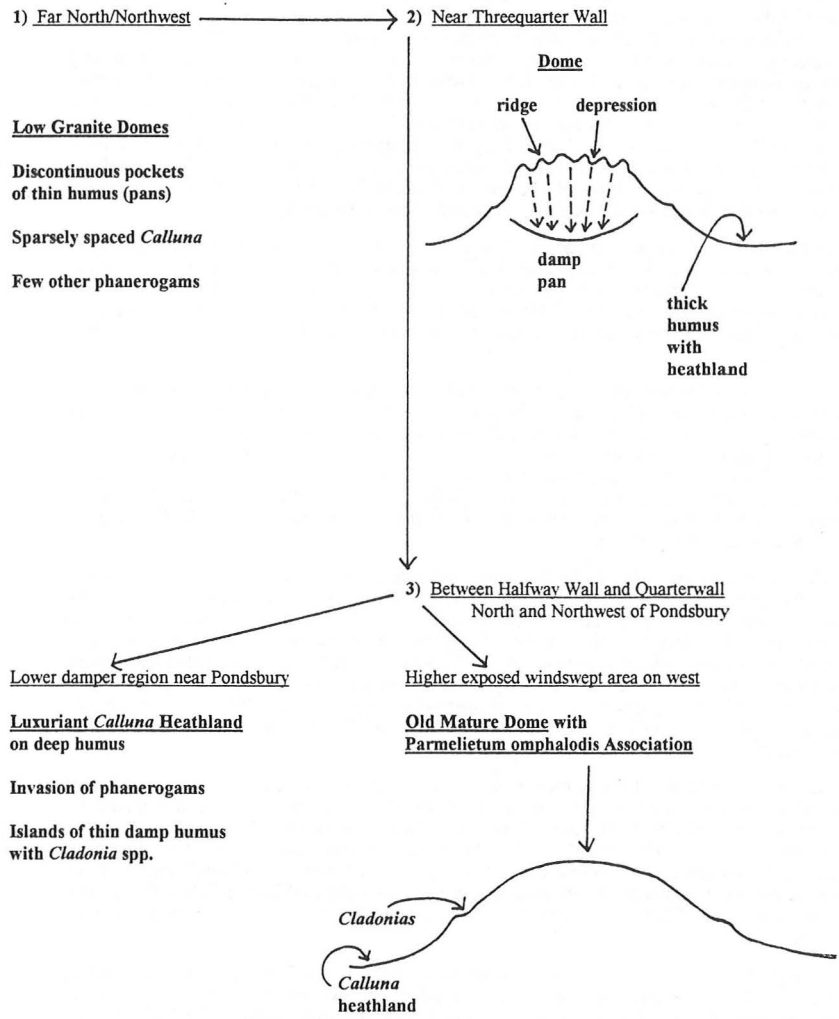


Figure 3. Succession: Granite Dome and Humus Sequence

In this area, pioneering plants of *Calluna vulgaris* grow on the sparsely humus-filled declivities between the granite domes; plants are often well spaced, dwarfed or juvenile, and prostrated by wind exposure. This flattened habit assists in anchoring the slowly accumulating humus under individual plants. Under drought conditions, aggravated by drying easterly winds, the younger plants are vulnerable due to the thinness of the humus layer; such plants turn brown and die thus adding to the humus layer. Many of these shallow pans are therefore eventually covered by a thin (to 1 cm thick) layer of accumulated humus which is coarsely cracked and mosaic-like when dry, swelling and becoming continuous when wet. The surface of these 'areoles' is covered by a binding felt of lichens, mosses and hepatics; *Cladonia furcata* and *C. cervicornis*, mainly present as basal squamules only, are the predominant humus-binders in these pans. Additional species are *Cladonia subcervicornis* and *C. polydactyla* and, very occasionally, *C. foliacea* and *C. ramulosa.* Few phanerogams appear on the thin humus - mainly small rosettes of *Plantago coronopus,* a few individuals of *Spergularia rupicola,* and scattered plants of the annual *Radiola linoides;* an abundance of *Sedum anglicum* often borders the 'areoles' of the pan mosaic, when dry.

2) The intermediate stage of development to a deeper humus cover and well-colonised granite occurs towards Threequarter Wall. Here the granite is exposed as scattered, white or grey domes, with a more or less continuous intervening *Calluna-Cladonia*-dominated heathland interspersed with patches of species-rich phanerogams and *Pteridium.* The depth of the humus layer here is, on average, 5 cm - in some places up to 12 cm.

The granite domes have a series of undulating ridges and corresponding runnels or declivities, each with its distinctive lichen flora. The ridges appear pale grey due to the abundance of *Lecanora gangaleoides, Ochrolechia parella, Pertusaria pseudocorallina, Ramalina siliquosa, Rinodina atrocinerea* and, less frequently, *Rhizocarpon richardii* and *Tephromela atra;* additional rarer species are *Anaptychia runcinata, Aspicilia epiglypta, Parmelia glabratula* subsp. *fuliginosa, P. perlata, Pertusaria amara, Porpidia cinereoatra, P. platycarpoides, Ramalina cuspidata, Verrucaria fusconigrescens* and *Xanthoria parietina.*

The declivities are often distinctly brown-coloured due to the abundance of *Parmelia loxodes* and *P. verruculifera*; *P. conspersa* is infrequent. Additional species in the runnels are *Buellia punctata, Candelariella vitellina, Lecanora gangaleoides* and *Rinodina atrocinerea* with, rarely, *Hypogymnia physodes, Lecanora polytropa, Lecidella scabra, Physcia tenella* and *Rhizocarpon richardii.* The ridges are more exposed, intermittently drier and less nutrient-enriched than the runnels. Towards the west coast additional species such as *Hypogymnia tubulosa, Lithographa tesserata* var. *petraea, Rinodina luridescens, Trapelia involuta* and *T. obtegens* sometimes enter this community.

Below the summits of the domes, where water tends to temporarily collect and persist for short periods, shallow pans develop in which the lichen flora is dominated by *Parmelia omphalodes* with, more rarely, *Fuscidea cyathoides, Hypogymnia physodes, Parmelia loxodes, P. saxatilis, P. sulcata, Pertusaria pseudocorallina, Ramalina siliquosa, Rinodina atrocinerea and Sphaerophorus globosus*, although much of the rock surface may remain uncolonised. These pans, as indicated by the lichen flora, seem to be nutrient-deficient and acidified by surrounding humus development and its run-off.

Conspicuous on the edges and marginal mats of the humus development surrounding these domes is a range of *Cladonias* and other foliose and fruticose species, some actively binding the humus, others on older bare *Calluna* stems. *Cladonia furcata* remains dominant with variable development of podetia; also present in the community are *C. cervicornis* and *C. diversa* and, to a lesser extent, *C. chlorophaea, C. floerkeana, C. foliacea, C. macilenta, C. polydactyla, C. rangiformis, C. subcervicornis* and *C. uncialis. Coelocaulon aculeatum, Sphaerophorus globosus* and detached *Usnea flammea* are widely distributed but scarce in pockets of shallow humus with low *Calluna* cover. *Placynthiella icmalea* and *Micarea prasina* are found occasionally on the margins of the damp peat surrounding *Calluna* tussocks/mounds. Occasionally,

especially towards the northeast, *Cladonia strepsilis* invades the damper areas covered in thin peat.

A secondary phanerogamic flora invades some areas of consolidated *Calluna* on deep humus and includes juvenile *Calluna* with *Aira praecox, Armeria maritima, Carex arenaria, Festuca ovina, Holcus lanatus, Sedum anglicum* and *Spergularia rupicola.* Notably, only *Carex arenaria* is able to survive within the pure stands of *Calluna*, its elongated leaves standing out above the general level of the *Calluna.*

Mature *Calluna*, especially at the edge of granite domes, often becomes prostrated and partially denuded of leaves. The stems then provide a substrate for colonisation by lichens including *Anaptychia runcinata* (rare), *Cliostomum griffithii, Hypogymnia physodes, H. tubulosa, Lecanora confusa* (rare), *L. expallens* (often fertile), *Parmelia caperata, P. perlata, P. reticulata* (rare), *P. saxatilis, P. sulcata* and *Usnea flammea.*

3) The final stage in the establishment of the characteristic *Calluna* heathland is best seen on the north side of Punchbowl Valley where it slopes down into a moister heathland above Pondsbury. The increasing abundance of *Cladonia cilata* var. *tenuis, C. portentosa* and *C. uncialis* is apparent in small, poorly drained pockets of shallow humus where *Calluna vulgaris,* with occasional plants of *Erica cinerea* and *E. tetralix,* otherwise forms an almost uninterrupted carpet associated with the better developed consolidated peat.

The significant feature of this interesting region is the restriction of the *Cladonia* pockets amongst mature *Calluna* heathland to these narrow or very confined drainage areas, often where the depth of the overlying humus is no more than 1 cm. These pans, like islands in the *Calluna* heathland, vary in size and are covered by a range of lichens, the shortest at the centre and the tallest, to a height of 3 cm, at the margins abutting the surrounding *Calluna. Cladonia furcata* (juvenile), *C. cervicornis, C. diversa* and *C. floerkeana* in the centre are surrounded by *C. furcata* (polymorphic with well developed, often fertile, podetia), *C. gracilis* (rare), *C. squamosa* (rare), *C. uncialis, Coelocaulon aculeatum* and *C. muricatum.* Sparse *Carex arenaria* and *Rumex acetosella* often invade these pans. At the margins of the larger pans and solely in small, infilling pockets in the heathland are well developed *Cladonia ciliata* var. *tenuis, C. portentosa, C. azorica* (but see Appendix p. 123), and *C. uncialis*, all of which become fertile with well developed apothecia. These upwardly growing lichens successfully compete with phanerogams and sustain a more prolonged presence within the *Calluna* heathland. This community above Pondsbury is undoubtedly one of the most interesting on the island.

On the west side of the island, north of Quarterwall and rising to the north of Punchbowl Valley, is a group of well established older granite domes in heathland which is dominated by *Calluna vulgaris* and includes pockets of *Aira praecox, Armeria maritima, Erica tetralix, Festuca rubra, Sedum anglicum* and *Spergularia rupicola*, essentially similar to the Threequarter Wall heathland described earlier. The windswept, low granite domes have a lichen community representing the Parmelietum omphalodis Association (See p.104). Nutrient enrichment of lower more sheltered old domes causes a shift in the lichen community with *Parmelia omphalodes* in the foregoing being replaced with *Parmelia conspersa,* together with *P. loxodes* and *P. verruculifera. Candelariella vitellina, Lithographa tesserata* var. *petraea, Pertusaria pseudocorallina, Porpidia platycarpoides, Rinodina atrocinerea,* and the moss, *Grimmia maritima,* are also in these communities which represent the Parmelietum glomelliferae Association. The vegetation patterns on these granite domes mirrors that of older exposed domes elsewhere on the northern part of the island and can be considered as the final stage in humus consolidation and lichen colonisation.

CALCICOLOUS COMMUNITIES: BUILDINGS AND WALLS

Most walls and buildings on Lundy are constructed from granite though a few at the southern end of the island are built of slate. Both types of wall normally include at least a few 'alien' elements such as brick, slate in granite walls or vice versa. Furthermore, many constructions are plugged and strengthened by concrete or rarely mortar in the interstices which provide the only man-made basic saxicolous substrate on the island (with the exception of the marble gravestones). A few walls have an additional capping

of soil which is the main habitat for such rarities as *Chromatochlamys muscorum, Bacidia bagliettoana* and *Polyblastia gelatinosa,* all of which grow on or with mosses.

Of the 45 lichens which are more or less exclusively associated with basic substates the greatest diversity and abundance can be seen on the walls around The Shop and Marisco Tavern, and the wall leading to as well as the ruins at The Battery. The ubiquitous species are: *Bacidia sabuletorum* (on moss), *Caloplaca citrina, C. flavescens, Diplotomma alboatrum, Lecanora albescens, L. dispersa, Lecidella stigmatea, Toninia aromatica, Verrucaria glaucina, V. hochstetteri, V. muralis* and *V. viridula* and the closely associated, *V. macrostoma*; most of these species have a wide ecological amplitude and are well represented in shaded as well as exposed habitats.

Shaded and/or sheltered walls with cement often bear species found more rarely on the island such as: *Acrocordia salweyi, Agonimia tristicula, Clauzadea monticola, Collema auriforme, C. crispum, C. tenax, Gyalecta jenensis, Leptogium schraderi, L. teretiusculum; Lecania rabenhorstii* and *L. turicensis* often occur on brick. A slight increase in nutrient status encourages the colonisation of *Caloplaca holocarpa* s.str., *Diploicia canescens, Phaeophyscia orbicularis, Physcia adscendens, P. tenella* and *Rinodina gennarii.* Acid rock surfaces adjacent to cement have *Caloplaca dalmatica, Diplotomma chlorophaeum, Lecanora campestris, Opegrapha saxatilis* (the *O. chevallieri* ecotype), *Rhizocarpon concentricum* (on slate) and, sometimes, *Diploicia canescens.*

The siliceous wall flora closely resembles that already described for outcrops but a few species appear to be more characteristic of man-made habitats than natural rock. They include *Buellia aethalea* (slate), *B. stellulata* (granite and slate, rare), *Fuscidea lygaea* (granite, rare), *Lecania hutchinsiae* (slate, locally abundant under *Acer*), *Lecanora fugiens* (granite), *Ramalina canariensis* (granite), *Ramalina lacera* (granite) and *Sarcogyne privigna* (granite, rare). *Lecidea diducens* is only recorded from a granite wall and a dressed granite stone in the graveyard. Unfortunately, recent moderate eutrophication has adversely affected the walls northward along the track from The Shop to Quarterwall with the loss of *Ramalina canariensis* and *R. lacera.* It is hoped that the cause and damage are transitory, but it will take several years for the lichen flora to recover, once the source of eutrophication is removed.

Special mention has been made of the wall of the calor gas storage house near Millcombe House, a slate-mortar wall (p. 101).

There are three prominent granite, east-west traversing walls on the island. Quarterwall (pre-18C), Halfway Wall (1752) and Threequarter Wall (1872). The fact that these walls can be accurately dated (see Thackray 1989), and in part have not been subsequently disturbed, means that their lichen floras can be assessed on the north and south sides of each wall. The oldest; Quarterwall, has partially collapsed and is replaced in the east by wire but is still intact in the west as an earth-stone barrier about 1.5m high; the other two walls are mostly complete and are typically dry stone without earth or cement and are about 2m high. A study of the lichen distribution, percentage cover, and species diversity is summarised in Table 1.

Table 1: **Comparison of Distribution of Lichens on Walls**

	Quarterwall (west)	Halfway Wall (west)	Threequarter Wall (central, near track)
Age	ancient (pre 18th century)	1752	1872
Total no. species	41	50	36
Percentage cover on south face	95%	80% (90% in centre of island)	70%
Percentage cover on north face	95%	35% (50% in centre of island)	40%
Key species on south face	Common: dominant *Parmelia omphalodes* *Pertusaria pseudocorallina* *Ramalina siliquosa* *Rhizocarpon richardii* Occasional *Caloplaca crenularia* *Cladonia foliacea* *C. furcata* *Lecanora gangaleoides* *Ochrolechia parella* *Parmelia saxatilis* *Parmelia sulcata* Other *Parmelia* species *P. perlata* Other species of note *Cladonia cervicornis* *Lecanora rupicola* *Lecidella prasinula* *Pertusaria amara*	Common: dominant *Lecanora gangaleoides* *Pertusaria pseudocorallina* *Ramalina siliquosa* Occasional *Fuscidea cyathoides* *Parmelia sulcata* *Rhizocarpon richardii* Other *Parmelia* species *P. caperata* *P. reticulata* *P. saxatilis* Other species of note *Lecanora rupicola* *Lecidella prasinula* *Pertusaria amara*	Common: dominant *Pertusaria pseudocorallina* *Ramalina siliquosa* Occasional *Fuscidea cyathoides* *Parmelia saxatilis* *Pertusaria amara* *Ramalina subfarinacea* *Usnea flammea* Other *Parmelia* species *P. caperata* *P. glabratula* subsp. *fuliginosa* *P. omphalodes* *P.reticulata* *P. perlata* *P. sulcata* Other species of note *Lecanora gangaleoides* *Lecidella prasinula*
Key species on north face	Common: dominant *Pertusaria pseudocorallina* *Porpidia platycarpoides* Occasional *Haematomma ochroleucum* var. *porphyrium* *Lepraria* sp. *Parmelia sulcata* *Ramalina siliquosa* Other species of note *Cladonia cervicornis* *C. chlorophaea* *C. diversa* *Lecanora expallens* *Lecidella scabra* *Leprocaulon microscopicum* *Ochrolechia androgyna* *Pertusaria amara*	Common: dominant No clearly dominant or common species Occasional *Haematomma ochroleucum* var. *porphyrium* *Lecanora expallens* *L. tenera* *Polysporina simplex* Other species of note *Diploicia canescens* *Lepraria incana* *L.* sp. (yellow) *Ochrolechia androgyna*	Common: dominant No clearly dominant or common species Occasional *Lepraria* sp. (grey) *L.* sp. (yellow) *Parmelia glabratula* subsp. *fuliginosa* *Pertusaria pseudocorallina* *Ramalina siliquosa* Other species of note *Haematomma ochroleucum* var. *porphyrium* *Lecanora expallens* *L. tenera* *Pertusaria amara* *Polysporina simplex*

The following conclusions can be drawn from the data in Table 1.

1 The percentage cover of lichens is highest on the oldest wall (Quarterwall) and lowest on the most recent wall (Threequarter Wall). This reflects the slow rate of colonisation and very slow growth of lichens which, in the case of foliose species, is up to 0.5 cm a year and, for crustose species, less than 1 mm per year. Species diversity is rather less on Threequarter Wall and is highest on Halfway Wall suggesting that diversity, unlike cover, does not necessarily increase with age of the substrate but is dependent on other factors, including growth rates of competing lichens.

2 The percentage cover is generally greater on the south-facing side of all three walls. This aspect receives higher illumination (sunlight), more direct, but intermittent, wetting from rain and more wind exposure accompanied by some salt blast. Furthermore, these factors tend to encourage the growth of foliose species which have a faster growth rate than crustose species. The north-facing sides are more sheltered, shaded, and have a higher more sustained humidity level but are less or not directly wetted by rain; this aspect is mainly colonised by slower growing crustose species.

3 The floras on either side of the walls are distinctive and are more or less similar for each north- or south-facing aspect of all three walls. Local factors, eg shelter under phanerogams at the bases of walls, create conditions which either favour certain species already present or may be the site of species not otherwise represented.

4 Some common species show very considerable ecological tolerance; *Pertusaria pseudocorallina* is well developed, occasionally fertile and with well-formed and numerous isidia on the south side but is also common in a stressed condition - thinner thallus, fewer isidia and not fertile - on the north side; *Lecanora gangaleoides* shows a similar tendency with apothecial development almost suppressed on the north side.

5 *Parmelia* species are mainly confined to the south-facing side of the walls and thalli are particularly abundant at the base of the wall where they are sheltered in summer and autumn by taller herbaceous vegetation, especially *Pteridium aquilinum*. A similar increase in abundance on the summits of the walls reflects a preference for more exposed, somewhat nutrient-enriched, often more or less horizontal surfaces in contrast with the less moisture-retaining, vertical sides of stones in the middle of the walls. *Parmelia saxatilis* on the north-facing sides of walls has narrower, elongated, discrete lobes with few isidia and is a typically stressed condition of a species with a wide ecological amplitude.

6 By contrast, north-facing aspects have many species common to natural, sheltered underhangs of the neighbouring outcrops. Many of the species, eg *Haematomma ochroleucum* var. *porphyrium*, *Lepraria incana* and *Leprocaulon microscopicum* have a powder-like thallus containing non-wettable lichen substances, not wettable by raindrops but dependent on the ambient levels of humidity. An exception appears to be the rather local *Lecidella prasinula* which has a similar thallus but is confined to the south side.

7 The growth of *Cladonia* species on Quarterwall is directly the result of capping and the consequent accumulation of humus.

8 *Ramalina siliquosa* and *Usnea flammea* are most frequent on or near the summits of Threequarter Wall at one of the highest points on the island. This is consistent with their known affinity for windy, fully exposed situations.

BEACON HILL CEMETERY

The small cemetery near the Old Light contains 26 inscribed markers and gravestones, mostly of local granite and a few of slate (see Langham 1994). Some stones within the cemetery enclosure are of great antiquity, eg remains of a fourth century hut circle, four ancient burial stones and a collapsed 12-13th century chapel (see Thomas 1991). Many

vertical memorials are tilted in various directions and, with several chest tombs and some rough hewn crosses, present a diverse number of aspects for selective lichen colonisation. The only other rock substrate is the seldom imported, very smooth, basic marble of a few horizontal markers and a cross. In all, 54 species, mainly belonging to the Ramalinetum scopularis and Parmelietum glomelliferae occur on the stones; the marble is very poor in calcicole species (see Table 2).

Of particular note is a conspicuous upright east-west facing slate gravestone, dated 1892 (to 'Helen Elizabeth', 'beloved wife of Samuel Mayor Hast', see Plate 2, at rear). This has, near the top of its east-facing side, some very discrete, individual and large colonies of *Tephromela atra* and *Lecanora rupicola.* By comparing the age of the stone (1892) and measurement of the diameter of the colonies allowing for a period of colonisation, it is possible to estimate the growth rate of these two species: *T. atra*, 1.1 mm per year; *Lecanora rupicola*, 1.3 mm per year. *Buellia subdisciformis* forms a mosaic of small thalli on the righthand side and scattered small colonies of *Caloplaca crenularia, Fuscidea cyathoides, Pertusaria pseudocorallina, Ramalina siliquosa, Rhizocarpon obscuratum* and *R. richardii* are also present. The west face of the memorial is almost entirely covered with *Caloplaca crenularia.*

Two markers have copper memorial nameplates and in the seepage run-off from these both *Acarospora smaragdula* and *Lecanora dispersa* have assimilated so much copper that the thalli have turned yellowish-green and bluish-green respectively, indicating an uptake of this metal and its active incorporation within the lichen thallus, probably as copper oxalate. Another lichen of similar disposition, *Psilolechia leprosa,* which grows on calcareous substrates adjacent to copper, is present in small quantity below a copper lightning conductor against mortar on the Old Light wall nearby.

Table 2: **Lichens of the Beacon Hill Cemetery**

SPECIES	**GRANITE**		**SLATE**	**MARBLE**
	Boulders	**Gravestones**	**Gravestones**	**Gravestones**
Acarospora fuscata	+	+	-	-
Acarospora smaragdula	-	+*	-	-
Anaptychia runcinata	+	+	+	-
Buellia punctata	-	+	-	-
Buellia subdisciformis	-	-	+	-
Caloplaca citrina	-	+	-	+
Caloplaca crenularia	+	+	+	-
Caloplaca dalmatica	-	-	-	+
Caloplaca flavescens	-	-	-	+
Caloplaca holocarpa	-	+	-	-
Candelariella aurella	-	+	-	-
Candelariella vitellina	-	+	+	-
Catillaria chalybeia	-	+	-	-
Cladonia cervicornis	-	+	-	-
Diplotomma alboatrum	-	+	-	-
Fuscidea cyathoides	-	+	+	-
Lecania erysibe	-	+	-	-
Lecanora albescens	-	+	-	+
Lecanora campestris	-	+	-	-
Lecanora dispersa	-	+*	-	+
Lecanora fugiens	-	+	-	-
Lecanora gangaleoides	+	+	+	-
Lecanora orosthea	-	+	-	-
Lecanora polytropa	-	-	+	-
Lecanora rupicola	+	+	+	-
Lecanora sulphurea	-	+	-	-

SPECIES	GRANITE		SLATE	MARBLE
	Boulders	Gravestones	Gravestones	Gravestones
Lecanora umbrina	-	+	-	-
Lecidea auriculata	-	+	-	-
Lecidea diducens	-	+	-	-
Lecidella scabra	+	+	-	-
Lecidella stigmatea	-	+	-	-
Ochrolechia parella	+	-	-	-
Parmelia glabratula ssp *fuliginosa*	+	+	-	-
Parmelia saxatilis	+	-	-	-
Parmelia subaurifera	+	-	-	-
Parmelia sulcata	+	-	-	-
Pertusaria amara	+	-	-	-
Pertusaria pseudocorallina	+	+	+	-
Polysporina simplex	-	+	-	-
Porpidia cineroatra	+	-	-	-
Porpidia platycarpoides	+	-	-	-
Porpidia tuberculosa	-	+	-	-
Ramalina siliquosa	-	+	+	-
Ramalina subfarinacea	+	-	-	-
*Rhizocarpon geographicum**	-	+	-	-
Rhizocarpon obscuratum	-	-	+	-
Rhizocarpon richardii	+	+	+	-
Rinodina orculariopsis	+	-	-	-
Sarcogyne privigna	-	+	-	-
Scoliciosporum umbrinum	-	+	-	-
Tephromela atra	+	+	+	-
Toninia aromatica	-	+	-	-
Verrucaria viridula	-	+	-	-
Xanthoria parietina	-	+	-	+

Total = 54

***Note:** Colour variation beneath copper on stones to Amy Ruth 1931 and Felix Gade 1978.

TERRICOLOUS COMMUNITIES: *RHODODENDRON* PATH

The low path on the east side, near its beginning not far from Millcombe House, passes through a dense cover of *Rhododendron,* providing deep shade and moist peat banks with many exposed stumps and roots. This interesting habitat supports a rich terricolous community dominated by a well-developed Cladonietum coniocraeae Association: *Cladonia caespiticea, C. coniocraea, C. cyathomorpha, C. diversa, C. macilenta/polydactyla, C. ochrochlora, C. pyxidata (*woodland form) and *C. ramulosa,* with *Bacidia viridifarinosa, Lepraria* sp., *Micaria prasina* and *Placynthiella icmalea.*

EPIPHYTIC COMMUNITIES: TREES

A The Epiphytic Lichens, Trees and Summary Table (see Table 3)

Most trees and shrubs on Lundy are confined to the main, sheltered valley surrounding and below Millcombe House and the adjacent south- and east-facing coast. On the south-facing side of this valley, the trees (up to 60 years old) - *Acer pseudoplatanus, Euonymus europaeus, Fraxinus excelsior, Ilex aquifoliuim, Quercus ilex, Q. robur (hybrid)* and *Pinus* sp. - are mostly in poor or moribund condition due to storm and salt-blast damage. Some regeneration of *Acer* has occurred but otherwise

saplings of other tree species are absent.

On the north-facing, more sheltered aspect there is a narrow, rather densely planted woodland, mainly *Acer* with some *Fraxinus,* extended as outlying pockets of trees at the head of the valley and, to the south, overlooking the Landing Bay. Below Millcombe House, the walled garden, through which a small semi-permanent stream flows, had enclosed apple trees (*Malus* spp.), all of which have recently died due to ring-barking at their bases by deer; these trees, rich in lichens, have consequently been felled. Also in the bottom of the valley are scattered native *Salix* sp. and *Sambucus niger*, individuals of which also grow along the East Coast Path which leads to the Quarries above Quarry Beach; a fine *Quercus cerris,* with much *Usnea flammea* and *U. subfloridana* also occurs amongst the *Rhododendron* alongside this path. At the upper edge of the valley above Millcombe House and around the flagstaff are dense thickets of *Prunus spinosa.*

Considering the limited number of trees on the island the epiphytic (corticolous) lichen flora with 120 species is unusually rich. This diversity may, in part, be due to the considerable range of tree species, each with a differing bark structure and pH, the sheltered, rather moist, but well lit, terrain, and the history of long continuity of tree replacement in the valley. Table 3 lists the lichens and summarises the host trees and shrubs.

Acer supports the greatest diversity of lichens (56 species, Table 3). This is due to: 1) the relative abundance of this tree, 2) the presence of both mature trees and juvenile saplings which, because of differences in bark surface carry very different floras, 3) the rather flakey, constantly sloughed bark of mature trees which offers a ready supply of new surfaces for recolonisation, and 4) the relatively high pH (4.5-6.2) of the bark surface. *Quercus robur,* with a more acid, rough bark, also has a rich but different lichen cover (45 species). *Salix* has a varied lichen flora (35 species); the relatively even, smooth bark of neutral pH and a preference for moister, sheltered habitats favours the colonisation of several interesting species, eg *Bacidia delicata, Catillaria pulverea, Fuscidea lightfootii* and *Lecanora jamesii. Sambucus niger* has the most individual lichen flora (25 species), including otherwise rare species of *Bacidia* and *Caloplaca* as well as *Arthonia muscigena* and the very rare south-western *Rinodina biloculata*; *Lecanora sambuci,* always a rare species, is almost confined to this tree. The spongy, water-retaining texture of the bark is a contributory factor to this unusual lichen community. Several wind-tolerant species are associated with *Prunus spinosa* which grows near the flagpole in an exposed windswept position. These include *Evernia prunastri, Lecanora confusa, L. expallens, Ramalina farinacea, Usnea cornuta* and *U. flammea.*

Several unusual 'corticolous' habitats were also examined; of these the most outstanding is the substantial mat of exposed moribund rhizomes of *Polypodium vulgare* agg. on the upper edge of a derelict mortar-soil-brick wall in the ruins of Quarterwall Cottages which supports a rich lichen flora. Here, *Anisomeridium biforme, Bacidia friesiana, B. herbarum, Opegrapha atra, O. herbarum* and *O. ochrocheila* are well developed on the fern rhizomes. Elsewhere, *Opegrapha varia* s.lat. was observed on an old dead haulm of *Dryopteris* sp. at the entrance of a grotto near Quarry F (see James *et al.* 1996).

Table 3: **Distribution of Epiphytic Lichens**

A = Acer
B = Calluna (d= dead)
C = Fraxinus
D = Malus
E = Pinus
F = Prunus
G = Quercus (* Holm Oak)
H = Salix
I = Sambucus
J : h = Hedera
rh = Rhododendron
u = Ulex
f = fern rhizome
r = Rubus
e = Euonymus

SPECIES	A	B	C	D	E	F	G	H	I	J
Acrocordia gemmata	+	-	-	-	-	-	-	-	-	-
Anaptychia runcinata	+	-	+	-	-	-	+	-	-	-
Anisomeridium biforme	+	-	+	-	-	-	-	+	+	f
Anisomeridium nyssaegenum	-	-	-	-	-	-	-	-	+	-
Arthopyrenia lapponina	-	-	+	+	-	-	-	-	-	-
Arthopyrenia punctiformis	-	-	+	+	-	-	+	-	-	-
Arthonia arthonioides	-	-	-	-	-	-	+	-	-	-
Arthonia impolita	-	-	-	-	-	-	+	-	-	-
Arthonia muscigena	-	-	-	-	-	-	-	-	+	-
Arthonia punctiformis	-	-	-	+	-	-	+	-	-	-
Arthonia radiata	+	-	-	-	-	-	+	-	-	-
Bacidia arceutina	-	-	-	-	-	-	-	-	+	u
Bacidia delicata	-	-	-	-	-	-	-	+	-	-
Bacidia friesiana	-	-	-	-	-	-	-	-	+	f
Bacidia herbarum	-	-	-	-	-	-	-	-	-	f
Bacidia laurocerasi	-	-	-	-	-	-	-	-	+	-
Bacidia naegelii	+	-	-	-	-	-	-	-	+	-
Bacidia phacodes	+	-	-	-	-	-	-	-	-	-
Buellia punctata	+	-	-	-	-	-	-	-	-	-
Byssoloma leucoblepharum	-	+d	-	-	-	-	-	-	-	-
Caloplaca cerina	-	-	-	-	-	-	-	-	+	-
Caloplaca holocarpa agg.	-	-	-	-	-	-	-	-	+	-
Candelariella reflexa	-	-	-	-	-	-	+	+	+	-
Catillaria pulverea	-	-	+	-	-	-	-	+	-	-
Chrysothrix candelaris	+	-	+	-	+	-	+	-	-	-
Chrysothrix chrysophthalma	-	-	-	-	+	-	+	-	-	-
Cladonia chlorophaea	-	+	-	-	-	-	-	+	-	-
Cladonia coniocraea	+	-	-	-	+	-	-	-	-	-
Cladonia fimbriata	-	-	-	-	-	-	-	+	-	-

SPECIES	A	B	C	D	E	F	G	H	I	J
Cladonia polydactyla	-	-	-	-	+	-	-	-	-	rh
Cliostomum griffithii	+	+	+	-	+	+	+	-	-	u
Dimerella pineti	-	-	-	-	-	-	-	-	-	e
Diploicia canescens	+	-	-	-	-	-	+*	-	-	-
Enterographa crassa	+	-	+	-	-	-	-	-	-	-
Evernia prunastri	+	+	-	+	-	+	+	+	+	-
Fuscidea lightfootii	-	-	-	+	-	-	+	+	-	-
Graphina anguina	+	-	-	-	-	-	+	-	-	-
Graphis scripta	-	-	+	-	-	-	-	-	-	-
Gyalecta truncigena	+	-	-	-	-	-	-	-	-	-
Haematomma ochroleucum var. *porphyrium*	+	-	-	-	-	-	-	-	-	-
Hyperphyscia adglutinata	-	-	-	+	-	-	-	-	+	-
Hypogymnia physodes	-	+	-	-	+	-	+	-	-	-
Hypogymnia tubulosa	-	+	-	-	-	-	-	+	-	-
Lecanactis subabietina	+	-	-	-	-	-	-	-	-	-
Lecania cyrtella	+	-	-	-	-	-	-	-	+	h
Lecania cyrtellina	-	-	-	-	-	-	+	-	-	-
Lecanora chlarotera	+	-	+	-	-	+	+	+	-	-
Lecanora confusa	+	+	+	+	+	+	+	+	-	rh
Lecanora conizaeoides	-	+[d]	+	-	-	-	-	-	-	-
Lecanora expallens	+	+	+	+	+	+	+	+	+	rh
Lecanora hagenii	-	-	-	-	-	-	-	+	-	-
Lecanora jamesii	-	-	-	-	-	-	-	+	-	-
Lecanora sambuci	-	-	-	-	-	-	-	-	+	-
Lecanora symmicta	+	-	-	-	-	-	+	-	-	-
Lecidella elaeochroma	-	-	-	-	-	+	+	-	+	r
Lecidella elaeochroma f. *soralifera*	+	-	-	-	-	-	-	-	-	-
Lepraria incana	+	-	-	-	-	-	+	-	-	h
Lepraria sp.	-	-	-	-	-	-	+, +*	-	-	-
Leproloma membranaceum	-	-	-	-	-	-	+	-	-	-
Leproloma vouauxii	-	-	+	-	-	-	-	-	-	-
Macentina stigonemoides	-	-	-	-	-	-	-	-	+	-
Micarea prasina	-	-	-	-	-	-	-	+	-	rh

SPECIES	A	B	C	D	E	F	G	H	I	J
Mycoporum quercus	-	-	-	+	-	-	-	-	-	-
Normandina pulchella	-	-	-	-	-	-	+	-	-	-
Ochrolechia androgyna	-	-	-	-	-	-	+	-	-	-
Ochrolechia parella	+	-	+	-	-	-	-	-	-	-
Opegrapha atra	+	-	-	-	-	+	+	-	+	h, f
Opegrapha herbarum	-	-	-	-	-	-	-	+	+	f
Opegrapha ochrocheila	-	-	-	-	-	-	-	+	-	f
Opegrapha sorediifera	+	-	-	-	-	-	-	-	-	-
Opegrapha varia s. lat.	-	-	-	-	-	-	-	+	-	f
Opegrapha varia s. str.	+	-	+	-	-	-	-	-	-	-
Opegrapha vulgata	+	-	-	-	-	-	+	+	-	-
Parmelia borreri	+	-	-	-	-	-	-	+	-	-
Parmelia caperata	+	+	+	-	-	+	+	+	-	-
Parmelia exasperata	-	-	-	-	-	-	-	-	+	-
Parmelia glabratula ssp. *glabratula*	+	-	+	-	-	-	-	+	-	-
Parmelia perlata	+	+	+	+	+	+	+	+	-	-
Parmelia reticulata	+	-	-	-	-	-	-	-	-	-
Parmelia revoluta	+	-	-	+	-	-	-	+	-	-
Parmelia saxatilis	+	-	-	-	-	-	+	+	-	-
Parmelia subaurifera	+	+	-	+	-	+	-	+	-	-
Parmelia subrudecta	-	-	-	-	-	-	-	+	-	-
Parmelia sulcata	+	+	+	+	+	+	+	+	-	u
Peltigera lactucifolia	-	-	-	-	-	-	-	+	-	-
Pertusaria amara	+	-	-	-	-	-	-	-	-	-
Pertusaria hymenea	+	-	-	-	-	-	-	-	-	-
Pertusaria leioplaca	+	-	-	-	-	-	-	-	-	-
Pertusaria pertusa	+	-	-	-	-	-	+	+	-	-
Phaeographis dendritica	+	-	-	-	-	-	-	-	-	-
Phlyctis argena	+	-	+	-	-	-	+	-	-	-
Physcia adscendens	+	-	-	-	-	-	-	+	-	-
Physcia aipolia	+	-	+	+	-	-	-	+	+	u
Physcia semipinnata	-	-	+	+	-	-	+	-	-	-
Physcia tenella	-	-	-	-	-	-	-	-	+	-
Physconia distorta	-	-	-	-	-	-	+	-	-	-

SPECIES	A	B	C	D	E	F	G	H	I	J
Porina aenea	+	-	-	-	-	-	-	-	-	-
Porina borreri	+	-	-	-	-	-	-	-	-	-
Pyrenula chlorospila	+	-	+	-	-	-	-	-	-	-
Pyrenula macrospora	+	-	+	-	-	-	-	-	-	-
Pyrrhospora quernea	+	-	-	-	-	-	+	-	-	-
Ramalina calicaris	-	-	-	-	-	-	+	-	-	-
Ramalina canariensis	-	-	-	-	-	-	+	-	-	-
Ramalina farinacea	+	+	-	-	-	+	+	-	-	-
Ramalina fastigiata	+	-	-	+	-	-	-	-	-	-
Ramalina portuensis	-	+[d]	-	-	-	-	+	-	-	-
Ramalina subfarinacea	-	+[d]	-	-	-	-	-	-	-	-
Rinodina biloculata	-	-	-	-	-	-	-	-	+	-
Rinodina sophodes	+	-	+	+	-	-	-	-	-	-
Schismatomma decolorans	+	-	-	-	-	-	+	-	-	-
Scoliciosporum chlorococcum	-	-	-	+	-	-	-	-	-	-
Teloschistes flavicans	-	+[d]	-	-	-	-	-	-	-	-
Tephromela atra	+	-	+	-	-	-	-	-	+	-
Trapeliopsis granulosa	-	-	-	-	-	-	-	+	-	-
Usnea cornuta	-	-	-	-	+	+	+	+	-	-
Usnea flammea	-	-	-	-	+	+	+	-	-	-
Usnea rubicunda	-	-	-	-	-	-	+	-	-	-
Usnea subfloridana	-	-	-	-	-	-	+	+	-	-
Xanthoria parietina	-	-	+	-	-	-	-	-	+	-
Xanthoria polycarpa	-	-	-	-	-	-	+*	-	-	-
n = 120	56	17	28	18	12	14	45 *3	35	25	

B Factors Affecting the Distribution of Epiphytic Lichens

The lichens of tree trunks take up characteristic positions, depending upon their specific requirements for aspect, illumination, exposure, and moisture as well as certain physical and chemical conditions of the bark substrate itself. These requirements, together with competition between individual thalli (intraspecific) and between species (interspecific) lead to a more or less well developed vertical zonation and distribution around the circumference. Additionally, air pollutants and eutrophication from inorganic fertilisers may stress and modify such communities; it is a matter of differing requirements, tolerance levels and comparative ability innate in each species.

Two adjacent *Quercus robur* trees of moderate age (c. 60 years, girth c. 1.5m) show interesting distributions of lichens at a height of about 2 m. A detailed study of two horizontal ring transects A and B (Fig. 4) reveals on the more exposed, well-lit and

wettest side of the trunks (south-, south-west- and south-east-facing) an extensive cover of the large leafy species of *Parmelia* (especially *P. caperata,* with *P. perlata* and a little *P. saxatilis*). These lichens largely depress the development of the smaller, closely appressed crustose species, many of which are thus adapted and confined in the driest area of the trunk. Many of these species, eg *Schismatomma decolorans* and *Arthonia arthonioides* have thalli which repel water droplets by means of a powdery surface and the presence of incorporated non-wettable lichen substances. Other crustose species favouring the dry side on these trunks include: *Cliostomum griffithii* and *Chrysothrix candelaria* with a little *Enterographa crassa, Opegrapha vulgata, Ramalina canariensis* and *R. farinacea.* Wind gusting across the valley contributes to the positions of the wind-dependent species, *Ramalina portuensis* (where drier) and *Usnea flammea* (where wetter, and also competing successfully with *Parmelia* spp. because it grows out from the bark).

Some stratification of lichen communities, as indicated above for tree boles, also occurs on large horizontal branches, especially of *Acer pseudoplatanus.* Although different species may be involved the pattern is similar: leafy and shrubby lichens on the upper well-lit side; shade-loving, crustose or powdery lichens on the sides and underneath.

CONSERVATION AND SUMMARY

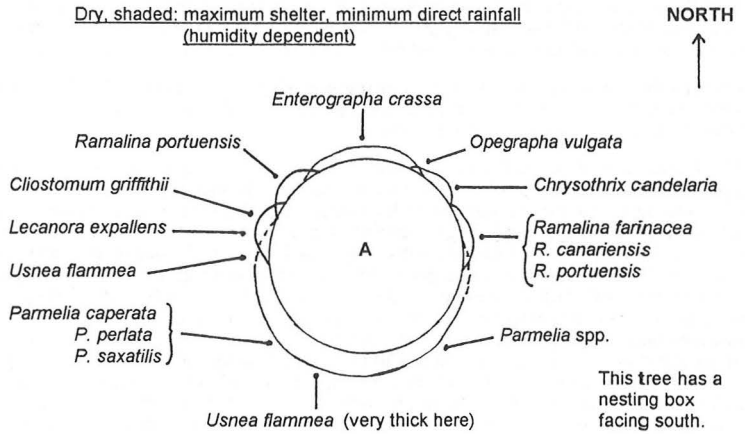
The current balance between human activities and natural conditions on Lundy is beneficial for the diversity of the lichen flora. Walls and buildings, some mortared, others derelict, old quarry workings and planted trees, all increase the range of habitats and ensure a rich lichen flora which should be maintained. The individual preferences of the rich corticolous flora reflect the wide range of different tree species, and this has significant implications for the island's tree planting programme: trees should be replaced and augmented where necessary. The proposed tree nursery near Millcombe House is a step in the right direction.

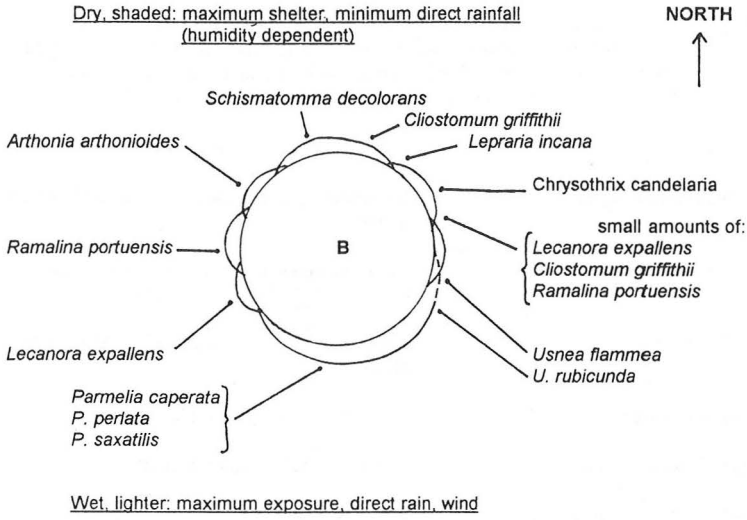
Generally, current farming practice is in accord with maintaining a consistently healthy environment for lichens. However, the application of inorganic fertilisers and silage gives rise to eutrophication and should be kept at a minimum level, considering that a single small airborne contamination from these sources can rapidly decimate sensitive lichen communities.

Trampling of the fragile heathland communities developing on granite, for example at the North End, could present an increasing problem. Currently, little damage is caused by the number of visitors and grazing on this part of the island, but any increase could easily bring on a breakdown and loss of the delicate thin humus cover on the granite plateau. Trampling, and the use of controlled burning, if required, need a strict monitoring programme. Furthermore, the area just north and northwest of Pondsbury, which is very rich in lichens and represents the final stage in the humus/granite dome succession, is under considerable stress from time to time due to grazing animals and drought conditions in recent summers. Measures should be taken to reduce these pressures as much as possible and conserve these characteristic heathland communities.

Although the National Trust owns Lundy, Landmark Trust undertakes the upkeep of the walls and the various derelict buildings (see Thackray 1989). Continuing sympathetic repair of the major east-west walls of dry stone construction is of utmost importance, in order to preserve the distinctive lichen communities associated with these ancient walls, which can be dated. In any rebuilding programme, old stones should continue to be used wherever possible and replaced respecting their former aspect and position. Use of mortar and cement in these walls should be confined to very limited areas (eg near stiles or gates) and resorted to only if additional strengthening is essential, as the introduction of these alien materials impacts on the lichen flora. The derelict buildings, however, often had concrete and mortar incorporated in their initial construction and support a number of calcicolous lichens. Continuing use of these materials to provide reinforcement would enable the ruins to survive and maintain their diverse and interesting lichen flora, as well as provide focal points in the landscape.

Figure 4. ***Quercus robur*** **Boles: Effects of Aspect, Moisture and Wind on Lichen Distribution**





The Cemetery, although small, contains a number of historically important stones, interesting memorials and some unusual lichens. There are also very fine examples of tombstones which, because they are dated, make it is possible to study the growth rate of lichens on them accurately. This essentially undisturbed sanctuary retains an intact lichen flora accessible and of interest to visitors. Its preservation relies on maintenance of existing walls and ensuring the gate remains closed, to protect from over-grazing; however, a regime of moderate, controlled grazing would keep down rank vegetation.

Fortunately, the recent oil spillage from the *Sea Empress* disaster at Milford Haven, Dyfed, reported as reaching Lundy, has not caused any noticeable effect on the lichens of the shoreline sites visited by the authors.

The lichen taxa recorded for Lundy, total 348, can be compared with those for other islands of southwestern Britain: 248 taxa for Skomer Island, Dyfed (Wolseley *et al.* 1996) and 380 taxa for the Isles of Scilly (James and Printzen in ms.). Skomer has a more diverse geology, much larger seabird population dominated by Lesser Black-backed Gulls, but fewer calcareous substrates and is almost devoid of tree and shrub cover. The Isles of Scilly, while larger overall, are more comparable with Lundy being almost entirely of hard, crystalline granite. Like Lundy, the Scillies also have a less omnipresent seabird population and an even greater diversity of manmade calcareous substrates and, especially on Tresco, of corticolous habitats. These three locations, as well as Ramsay, Dyfed (approximately 250 taxa) and Bardsey (365 taxa) (Fletcher, pers. comm.), occupy exposed Atlantic oceanic situations off the western seaboard of England and Wales and thus, at times, receive the full brunt of fierce, salt-laden, westerly storms. All taxa, therefore, except those in the most sheltered habitats, must be at least salt-tolerant. These islands, with their relatively undisturbed habitats, represent surprisingly diverse and important reservoirs of oceanic lichen communities; Lundy stands out as one of the most significant with its quota of rare lichens and the unique succession sequence of granite domes described in this paper.

APPENDIX: Lundy Lichen List

Total additional species: 33 taxa

Frequencies and distribution

Key: a = abundant, c = common, f = frequent, l = local, o = occasional, r = rare, s = scattered, w = widespread, * = previously recorded (Cox, 1960; Gliddon, 1948, 1949; Noon and Hawksworth, 1972). Nomenclature follows that of Purvis *et al* (1992) and the most recent Checklist (Purvis *et al*,1994).

Species		Habitat, Distribution
Arthonia arthonioides	r	dry aspect of single *Quercus* above Millcombe House
A. phaeobaea	r	sheltered rocks in mesic supra-littoral, North West Point, probably overlooked
A. lapponina	r	thin branches of *Fraxinus,* below Millcombe House
Aspicilia calcarea	r	concrete top of wall by The Shop
Bacidia lauricerasi	r	*Sambucus,* below Old Hospital
Byssoloma leucoblepharum	r	dead *Calluna* stems in sheltered recesses, between North East Point and Gannets' Bay

Caloplaca arenaria	r	sunny slate rocks, Landing Beach
Cladonia azorica	r	recent sudies (Anti in litt) suggest most (?all) British records refer to *C. portentosa* with both fumarprotocetraric and perlatolic acids
C. cyathomorpha	r	east coast, on crumbling, mossy earth bank under *Rhododendron* by lower path south of Quarter Wall; the large basal squamules have the very distinctive pale pink veins of this species (fumaroprotocetraric acid and unknown substance)
C. digitata	r	earth bank, by lower path south of Quarter Wall; underside of basal squamules richly sorediate (with thamnolic acid)
Cladonia ochrochlora	r	east coast, rotting stumps by path south of Quarterwall; this species is difficult to distinguish from *C. coniocraea* when young
Dimerella pineti	r	ancient *Euonymus* by Millcombe House
Diploschistes muscorum	r	parasitising *Cladonia* sp. on slate soil below the Castle
Graphis scripta	r	dead stems of old *Calluna* above Brazen Ward
Gyalecta truncigena	r	main harbour track on bole of single *Acer* near Millcombe House
Lecanactis subabietina	r	dry, sheltered base of old *Acer* near Big St John's
Lecania baeomma	o, w	sheltered, east- or north-facing coastal rocks, Quarries; North West Point; Brazen Ward, The Battery
Lecanora crenulata	o	cement in walls, near Marisco Tavern; derelict buildings, walls, The Battery; walls of Lighthouse, North West Point
Leproloma cacuminum	r	mosses on boulder amongst *Pteridium,* below Tibbett's Point
L. vouauxii	r	mostly *Fraxinus* tree boles, east-facing aspect below Castle Hill
Nephroma laevigatum	r	with *Teloschistes flavicans* on consolidated soil, above The Battery
Omphalina sp.	r	*'Botrydina'* basal thallus, damp soil above Gannets' Bay; not identifiable without mushroom-like fruits (basidiomata)

Opegrapha multipuncta	r	sheltered, damp rocks, spreading to the bases of *Calluna* stems, above Virgin's Spring
Parmelia delisei	r	scattered with *P. pulla* near Lighthouse, North End Point, rare at Brazen Ward
Pyrenocollema elegans	r	littoral zone, North West Point, with *Verrucaria striatula*
P. orustense	r	rocks among upper barnacle zone (upper littoral), North Lighthouse Quay
P. sublitorale	r (w)	with *P. halodytes* in littoral zone, Brazen Ward; North West Point, probably widespread
Ramalina pollinaria	r (o)	in small declivities of north-facing sides of bluffs between Pilot's Quay and The Cheeses
Rinodina biloculata	r	sheltered *Sambucus* at entrance to Quarry A (Orcularia-type spores)
Toninia mesoidea	r	in crevices, north-facing cliff by stairway to landing stage, North Lighthouse Quay; damp, north-facing soft rocks, Brazen Ward
Trapelia obtegens	r (o)	between crystals on granite, above North West Point
Trapeliopsis pseudogranulosa	r	on mossy banks more or less sheltered by *Rhododendron,* south of Quarter Wall
Verrucaria internigrescens	r	on slate, below the Castle

New distribution records are noted for the following previously recorded species:

Candelariella aurella	r	cement base of disused guide light, above Virgin's Spring
Ramalina portuensis	r	on *Quercus,* above Millcombe House with *R. canariensis*

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