Cyfoeth Naturiol Cymru
Natural Resources Wales

Survey of coastal lichens in two SSSIs in Ceredigion

D. M. Lamacraft & S.P. Chambers

Report No. 584

Lecanora fugiens amongst other coastal lichens on a wooden fence rail, Carreg Lydan, Ceredigion. © Dave Lamacraft Oct 2021.

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Crynodeb Gweithredol

Contractiwyd Dave Lamacraft gan Cyfoeth Naturiol Cymru i gynnal arolygon o gennau mewn dau SoDdGA arfordirol yng Ngheredigion a chontractiwyd S.P. Chambers i weithio ar y cyd â DML.

Mae SoDdGA Borth-Clarach tua 5km o hyd ac ymwelwyd â'r safle ddydd Sadwrn 25 Medi 2021 gan arolygu pedair ardal benodol, a oedd yn cwmpasu tua 600m o'r forlin yn y pennau gogleddol a deheuol.

Cofnodwyd 95 o dacsonau, gan gynnwys:
- 9 o rywogaethau'r Mynegai Creigiau Morol a Llethrau Arfordirol (MRCSI)
- 8 o rywogaethau oedd yn nodedig mewn rhyw ffordd arall e.e. *Arthonia punctella* sy'n Genedlaethol Brin.

Gyda chofnodion ychwanegol a ddarparwyd gan S.P. Chambers yn sgil ei ymweliadau blaenorol â'r SoDdGA a chofnodion a gasglwyd oddi wrth eraill, mae cofnodion 2021 yn dod â sgôr yr MRCSI i 14. Gan ddefnyddio cofnodion ar ôl 2000 yn unig, sy'n ymddangos yn dorbwynt derbyniol ar gyfer yr asesiad presennol hwn, 12 fyddai'r sgôr. Mae'n ymddangos yn annhebygol y byddai'r SoDdGA hwn yn cyrraedd trothwy'r MRCSI hyd yn oed gyda mwy o ymdrechion i arolygu.

Mae SoDdGA Aberarth-Carreg Wylan tua 50km o hyd ac ymwelwyd â'r safle ddydd Mercher 6 Hydref 2021 (pan arolygwyd pum ardal benodol) a dydd Iau 7 Hydref (pan arolygwyd chwe ardal benodol), gan gwmpasu tua 600m i gyd i gyfeiriad pen deheuol adran Ceredigion.

Cofnodwyd 152 o dacsonau, gan gynnwys:
- 24 o rywogaethau'r MRCSI,
- 21 o rywogaethau oedd yn nodedig mewn rhyw ffordd arall e.e. Cenedlaethol Anfynych a Chenedlaethol Brin.

Mae gan arolwg 2021 sgôr o 23 ar y MRCSI o'r arolwg hwn yn unig. Mae cofnodion hanesyddol wedi'u darparu gan Sam Bosanquet (yn y fanyleb) a chan S.P. Chambers o'i ymweliadau blaenorol â'r SoDdGA, sy'n dod â sgôr yr MRCSI i 35 gan ystyried yr holl gofnodion, neu 32 gyda'r cofnodion ar ôl 2000 yn unig. Mae'n ymddangos yn debygol iawn y byddai'r SoDdGA hwn yn cyrraedd trothwy'r MRCSI gyda mwy o ymdrechion i arolygu.

Un o'r pethau nodedig yn ardal Carreg Lydan yw cyfoeth rhywogaethol y ffensys pren meddal oedd yn cefnogi amrywiaeth dda o gennau morol. Prin yr oedd rhai o'r rhain wedi'u cofnodi, os o gwbl efallai, ar bren triniedig ym Mhrydain Fawr e.e. *Acarospora impressula*, *Myriospora fugiens* a *Caloplaca verruculifera*.

Dim ond crafu'r wyneb mae'r arolygon hyn wedi'i wneud, gyda thua 600m o forlin wedi'i harolygu ym mhob SoDdGA. Mae bron yn sicr y byddai mwy o waith arolygu'n canfod mwy o rywogaethau'r MRCSI a rhywogaethau nodedig eraill.

Ychydig o broblemau sy'n bodoli o ran rheoli cynefin; mae'n debyg mai'r prif un yw'r darnau helaeth o dir heb ei bori/heb ei reoli ar lethrau arfordirol, sy'n arwain at lystyfiant homogenaidd rhy doreithiog a fydd yn cyfyngu'n sylweddol ar botensial adrannau mawr o'r safleoedd SoDdGa hyn i fod yn addas ar gyfer cennau'r tir a chennau'r creigiau. Mae ardaloedd sydd â mwy o lystyfiant agored yn llawn cennau'r tir a chennau'r creigiau, gan gynnwys rhywogaethau'r MRCSI.

Executive Summary

Dave Lamacraft was contracted by Natural Resources Wales to undertake lichen surveys in two coastal SSSIs in Ceredigion with S.P. Chambers subcontracted to work alongside DML.

Borth-Clarach SSSI is around 5km in length and was visited on Saturday 25 September 2021 with four localities surveyed, covering about 600m of coastline at the north and south ends.

95 taxa were recorded including:

- 9 Maritime Rock and Coastal Slope Index (MRCSI) species
- 8 otherwise notable species e.g. the Nationally Rare *Arthonia punctella*.

With additional records provided by S.P. Chambers from his previous visits to the SSSI and from records collated from others, the 2021 records bring the MRCSI score to 14. Using post-2000 records only, which seems an acceptable cut-off for this current assessment, the score would be 12. It seems unlikely that this SSSI would meet the MRCSI threshold even with more survey effort.

Aberarth-Carreg Wylan SSSI is around 50km in length and was visited on Wednesday 6 October 2021 (five localities surveyed) and on Thursday 7 October 2021 (six localities surveyed), covering about 600m in total towards the south end of the Ceredigion section.

152 taxa were recorded including

- 24 MRCSI species,
- 21 otherwise notable species e.g. Nationally Scarce and Nationally Rare.

The 2021 survey scores 23 on the MRCSI from this survey alone. Historic records have been provided by Sam Bosanquet (in the specification) and by S.P. Chambers from his previous visits to the SSSI which brings the MRCSI score to 35 with all records considered, or 32 with post-2000 records only. It seems highly likely that this SSSI would reach the MRCSI threshold with further survey effort.

Of particular note in the Carreg Lydan area is the richness of the softwood fencing which supported a good range of maritime lichens, with a new GB record of *Catillaria flexuosa* and some species recorded only rarely or possibly never before on worked timber in GB e.g. *Acarospora impressula*, *Myriospora fugiens* and *Caloplaca verruculifera*.

These surveys have only really ‘scratched the surface’, with around 600m of coastline surveyed in each of the SSSIs, more survey work would almost certainly find additional MRCSI and other notable species.

Few habitat management issues exist, the main one is probably the extensive tracts of ungrazed/unmanaged coastal slope resulting in rank homogenous vegetation which will significantly limit the potential of large sections of these SSSIs to be interest for terricolous and saxicolous lichens. Areas with more open vegetation are rich in terricolous and saxicolous lichens including MRCSI species.

1. Introduction

Dave Lamacraft was contracted by Natural Resources Wales to undertake a baseline survey of coastal lichens in two SSSIs in Ceredigion. S.P. Chambers was sub-contracted to assist with the survey. The surveys took place over three days in September and October 2021.

1.1. Background

From the Project Specification (Bosanquet 2021):

The 2018 *Guidelines for Biological SSSIs: lichens and associated microfungi* includes a new index for selecting coastal lichen assemblages. This clarifies the lichen species which make up notified coastal lichen features on Skomer and Middleholm SSSI and Skokholm SSSI, but also highlights our patchy knowledge of coastal lichens in Wales. Only those two sites, Ynys Enlli SSSI, Glannau Aberdaron SSSI and St David's Peninsula Coast SSSI pass the selection threshold, although Ramsey/Ynys Dewi SSSI, Dale and South Marloes Coast SSSI and Strumble head - Llechdafad Clfifs SSSI come close to the threshold (Hudson, J. 2020. *Survey of the Maritime Rock & Coastal Slope Lichen Assemblage Feature at St. David's Peninsula Coast, Strumble Head - Llechdafad Cliffs and Dale & South Marloes SSSIs. NRW Evidence Report No: 470*).

The diversity of maritime lichens on other parts of the Welsh coast remains poorly known, although there are sufficient records from Mynydd Penarfynydd SSSI and Porth Ceiriad, Porth Neigwl ac Ynysoedd Sant Tudwal SSSI on the Llŷn Peninsula and from Aberarth - Carreg Wylan SSSI in Ceredigion to suggest that important assemblages occur elsewhere. The current survey therefore covers two SSSIs in Ceredigion; Borth-Clarach SSSI and Aberarth-Carreg Wylan (see Figure 1).

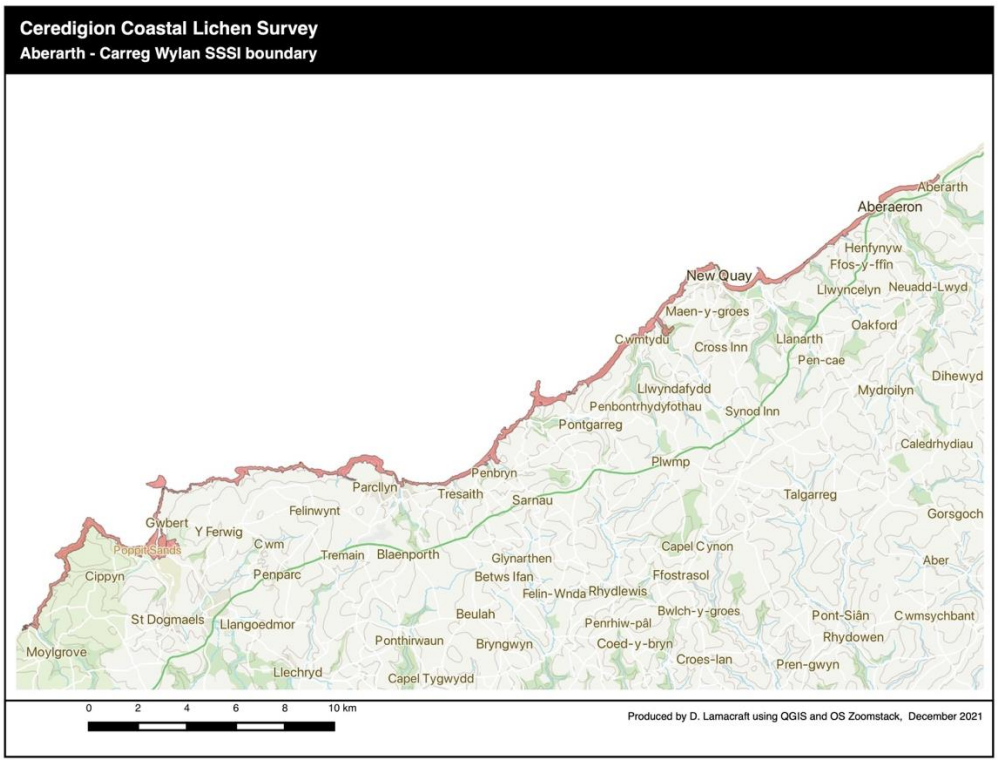
1.2. Scope of the Project

Visit both SSSI listed in Appendix 1 and carry out a baseline survey of coastal lichens, spending 2 days in Aberarth-Carreg Wylan SSSI (Ceredigion section) and 1 day in Borth-Clarach SSSI (looking at terricolous assemblage);

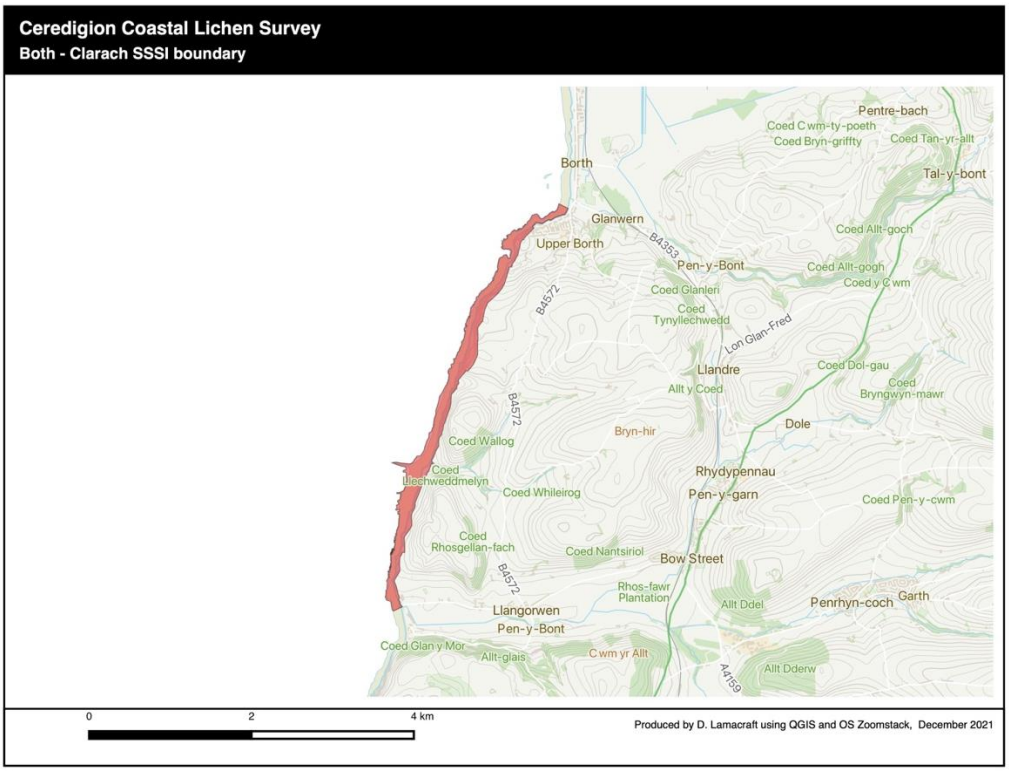
- Collaborate with local lichen experts, if possible, through sub-contracted joint fieldwork;
- Record all lichen species listed in the Maritime Rock and Coastal Slope Index at appropriate resolution. Population size and a 10-figure GPS reading should be given for rarer species, such as *Degelia* and *Roccella*, whilst a 4-figure GPS reading and frequency estimate will suffice for commoner species, such as *Diploschistes caesioplumbeus* and *Xanthoparmelia delisei*;
- Produce a spreadsheet of records in British Lichen Society format;
- Produce a report describing the diversity of Maritime Rock and Coastal Slope Index lichens in the two SSSI based on the current survey and previous reports.

Figure 1. The two survey areas

Aberarth - Carreg Wylan SSSI.



Borth – Clarach SSSI (Ceredigion).



2. Method

From the specification:

Visit both SSSI listed in Appendix 1 and carry out a baseline survey of coastal lichens; Collaborate with local lichen experts, if possible through sub-contracted joint fieldwork; Record all lichen species listed in the Maritime Rock and Coastal Slope Index at appropriate resolution. Population size and a 10-figure GPS reading should be given for rarer species, such as *Degelia* and *Roccella*, whilst a 4-figure GPS reading and frequency estimate will suffice for commoner species, such as *Diploschistes caesioplumbeus* and *Xanthoparmelia delisei*;

- Produce a spreadsheet of records in British Lichen Society format;
- Produce a report describing the diversity of Maritime Rock and Coastal Slope Index (MRCSI) lichens in the two SSSI based on the current survey and previous reports.

Given the limited time available (3 days total) full surveys were not possible so areas were selected to focus efforts based on previous records of interesting species and areas thought likely to be of interest. The areas selected were searched for MRCSI and other lichen species with efforts made to sample all main coastal habitats and niches present.

Recording was made using an iPhone SE, which was also used for taking photos along with an Olympus Tough TG-6 for macro photos. GPS readings were made using a Garmin GPSMAP 64s.

Every effort was made to identify lichens in the field, limiting the need for collection for later confirmation in the lab. The chemicals commonly used by lichenologists in the field, sodium hydroxide (NaOH) made from a diluted solution of caustic soda, and sodium hypochlorite (NaClO), in this case Milton Sterilising Fluid, were used for chemical tests to aid in field identification. Some specimens were collected for later microscopic confirmation.

Records were input into the standard British Lichen Society recording spreadsheet.

2.1. Nomenclature

Nomenclature follows that of the British Lichen Society's Taxon Dictionary (BLS 2021) except in the Target Notes in Appendix 2 which also adopt recent published changes e.g. with *Caloplaca*, in which case the BLS names are indicated. 'New' names used and their recently used synonyms are in Appendix 4.

3. Results

3.1. Borth-Clarach SSSI

This SSSI was visited on Saturday 25 September 2021 with four localities visited including soft cliff, a cliff-top clawdd and hard rock exposures on cliff top and beach. See Figures 2-3 for the survey route and for recording locations.

95 taxa were recorded including:

- 9 MRCSI species
- 11 otherwise notable species

The notable records are summarised below and presented in Tables 1a & 1b with a complete species list in Appendix 1 and detailed target notes in Appendix 2.

3.1.1. MRCSI species recorded

Arthonia phaeobaea MRCSI TNTN NS: very rare in Location D, a single small sterile (pycnidiate) thallus seen on the face of a hard Greywacke layer in the upper mesic-supralittoral zone a few metres away from *A.punctella*.

Caloplaca stillicidiorum (syn. *C.cerina* var. *chloroleuca*) MRCSI TNTN NS: rare in Location A; one strong patch adjacent to *Rinodina conradii* on narrow band of exposed dry soil on 'bare' lip on cliff edge under *Armeria maritima* and *Plantago maritima* maritime grassland vegetation, SN58571.84328, alt 35 m.

Diplotomma chlorophaeum MRCSI: occasional in Location A on hard cliff rock exposures above beach and in Location D generally sparse but in local concentrations on the harder faces of sandstone Greywacke units in the mesic-supralittoral zone.

Caloplaca maritima MRCSI TNTN NS: rare in Location A on soily sloping rock face at foot of hard rock cliff, GR SN5859684180.

Myriolecis fugiens MRCSI: Location A, on block face in pathside boulder bank.

Rinodina conradii MRCSI TNTN NS: rare in Locaiton A, on narrow band of exposed dry soil on 'bare' lip of cliff edge under *Armeria maritima* and *Plantago maritima* maritime grassland vegetation, SN5857184328, alt 35 m.

Solenopsora vulturiensis MRCSI: rare in Locations B and C, in crevices)

Trapeliopsis wallrothii MRCSI: rare in Location B on consolidated soil of anthill and numerous in Location C where frequently fertile.

Vahliella atlantica MRCSI TNTN NR: occasional in Location C - at least four good patches, the largest to c. 3 x 4 - 5 cm across, on consolidated dry acid soil on the middle part of the slope.

3.1.2. Other notable species

Arthonia punctella NR seen in very small quantity on c. three *Diplotomma chlorophaeum* thalli on the well-lit, dry face of a hard Greywacke layer, c. 10m up on an accessible part of sea cliff at SN59956.88143. The 2nd VC & Welsh record and the 1st on *D.chlorophaeum*.

Buellia stellulata NS?

Collemopsidium halodytes NS

Endococcus propinquus NS

Myriolecis zosterae NS

Lecidea swartzioidea NS

Lepraria nivalis NS

Scytinium biatorinum NS: in very small quantity in Location A on damp soil (fine argillaceous soil - rock crumb matrix) on soft cliff. Mostly present as minute proto-globules.

Scytinium palmatum NS

Scytinium tenuissimum VU (Wales) NS

Verrucaria prominula NS

3.1.3. Description of areas surveyed

The locations referenced below are shown in Figures 4-5.

Location A

A section of coast north from Glan-y-môr, Clarach Bay, centred on SN585842. The area of survey extended for approximately 300m north from the beach access to the the north of the Afon Clarach and comprised the following habitats:

I. loose, soft (i.e. undefended) glacial till sea cliffs.
II. limited areas of harder rock sea cliffs and rock shelves accessed from the beach.
III. dry short coastal cliff-top turf, ‘bare’ soil lips and dry erosion terracettes locally exposed along the edge of the cliff-top and alongside the coast path.
IV. a short c. 40 m length of traditional clawdd, stone-faced (boulder block) bank alongside the E-side of the coast path immediately above Glan-y-môr.

Location B

A small extent of N to NE-facing, steeply sloping rock exposures (some possibly formed by past small-scale local stone quarrying) and associated terricolous habitats on the cliff top a few metres distant from the coast footpath, centred on SN601887, alt 40-50m, c 100 – 250m NE of the War Memorial W of Upper Borth. The location had been surveyed previously by SPC on 5/7/2015.

Well-develop maritime lichen communities were absent with only a few species of coastal affinity occurring, the communities present being types more typical of sheltered acid inland rock, probably on account of the sheltered aspect of the rock faces with regard to the prevailing maritime influence, their height above and away from the main Craig yr Wylfa sea cliffs, and their likely fairly recent anthropogenic origin.

Location C

W-SW-facing, sparsely vegetated steep (c. 30-40 degrees) rocky slope directly above the landward side of the coastal path steps where it descends to the Brynrodyn covelet on the shore, c. 650 m SW of Upper Borth, centred on SN6002988210, alt c. 25-35 m. The upper part of the slope is cloaked in *Ulex europaeus* scrub and the lower open rock and soil habitats carry pronounced maritime-character plants, including *Silene uniflora.*

Most of the small central open part of the slope comprised crumbly to semi-stable rock surfaces and dry soil dominated by epigaeic and saxicolous cryptogams. The slope had a rich lichen flora with a number of interesting species present.

Location D

A short length of sea cliff running for approximately 200 m S from SN599882 to SN599880 within the tetrad. In comparison to the length to the N (Craig yr Wylfa in SN68 Tetrad E) previously surveyed by SPC in July 2015, the sea cliff appeared at least in sections far less eroded, possibly on account of the Silurian strata although of similar relative softness being more protected here from south-westerly storms than the very exposed Carreg Mulfran – Craig yr Wylfa section. Sections towards the far S-end however appeared more eroded at least as viewed from distance. The sea cliffs here form part of the Borth Mudstones Formation in the Llandovery Series of the Silurian and their fragile nature and vulnerability to marine erosion is recognised by geologists (Dobson *et al.* 1995).

Figure 2. Borth-Clarach SSSI survey locations, north

Figure 3. Borth-Clarach SSSI survey location A (south)

3.2. Aberarth-Carreg Wylan SSSI

This SSSI was visited on Wednesday 6 October 2021 (five localities searched) and on Thursday 7 October 2021 (six localities searched). See Figures 4-5 for survey routes and recording locations.

152 taxa were recorded including

- 24 MRCSI species,
- 21 otherwise notable species e.g. Nationally Scarce and Nationally Rare.

The notable records are summarised below and presented in Table 2 with a complete species list in Appendix 1 and detailed target notes in Appendix 2.

3.2.1. MRCSI species recorded

Aspicilia leprosescens MRCSI: recorded fertile in Location I on an upper rocky platform and steeply angled upright rock exposures of the lower shore which supported a good range of maritime lichens.

Bacidia scopulicola MRCSI: rare in Location I on upper rocky platform and steeply angled upright rock exposures of the lower shore, fertile and locally frequent in sheltered places in Location J, and rare, but seen fertile on sheltered rockface in Location E.

Buellia abstracta MRCSI NS: rare in Location B on a small (c. 3 x 1 cm) stone lying loose on southeast-facing slope of maritime grassland below crest at the top NW-end, SN181517, alt 25m (see Figure 29). The fourth VC-record and a new hectad record (SN15). Herb. SPC.

Caloplaca littorea MRCSI NS: very rare in Location I, c. three small thalli under overhang; the 3rd VC record, previously recorded only from Cardigan Island and the 1st record from the mainland VC.

***Caloplaca* "aff. *sorediella*"** MRCSI NR: rare in Locaiton D on dead base of *Armeria maritima* on rock slope in the mesic supra-littoral zone (see Appendix 3 Taxonomic Notes).

Caloplaca verruculifera MRCSI: of note was a single small, c. 1.5 cm diam., thallus on the flat cut top of one fencepost (see Figure 41). This species occurs almost exclusively on coastal rocks manured by seabird guano and only very rarely on timber on coastal fence-posts (Fletcher & Laundon, in Smith *et al.* 2009). This is the first such lignicolous Cardiganshire record. It is a phenomenally abundant and dominant lichen on the gullCardigan Island a few hundred metres offshore to the NW. Close-source, heavy propagule pressure has enabled it to colonize, likely vectored by gulls, from the island.(F) rare on nutrient-enriched sloping rockface below bird-perch (I)

Cliostomum tenerum MRCSI: rare under overhang in Location I.

Diploschistes caesioplumbeus MRCSI NS: rare in Location C with c. six thalli seen in one place on rock directly above the vertical cliff and occasional on well-lit hard rock faces in Location E.

Diplotomma chlorophaeum MRCSI: rare on outcrop above maritime grassland in Location B, and also in Locations I and J.

Halecania ralfsii MRCSI NS: seen in two places on shelving sloping rock in the upper littoral zone in Location D and several small thalli on one sloping rockface in Location I.

Hypotrachyna britannica MRCSI: a few thalli on one NW-sloping rock exposure in heath in Location B. See Figure 28.

Lecania aipospila MRCSI NS: two thalli on nutrient-enriched rock in Location I.

Lecania baeomma MRCSI NS: locally frequent in Location A, often extensively spreading, diffuse and mostly highly abraded, sorediate thalli, growing on sub-vertical, N-facing rock faces. Sterile, but fertile thalli were observed in c. four places with apothecia restricted to the more coherent and less abraded parts of thalli, on two rock faces. Soralia on abraded thalli were grey-yellow to pale grey-green in colour, lacking the usual characteristic inky-grey-blue speckling. The 1st VC 46 record. Voucher specimen in hb. SPC. See Figures 23-24.

Lecanora poliophaea MRCSI: rare on sloping rock face in Location D, growing with *Lecania atrynoides* adjacent. Specimen in hb. DML.

Lecidella meiococca MRCSI NS: occasional small patches on rock face occasional small patches on rock face in Location E, rare on rock outcrop in Location B and rare on rock faces in Location A.

Myriolecis fugiens MRCSI: pathside boulder in Location A on the dry sides of strainer posts in the fenceline, the largest thalli attaining c. 3 x 1 cm. Does not appear to have been reported growing on lignum before in Britain. Also in Location H.

Opegrapha cesareensis MRCSI: on dry rock faces under overhangs. Pycnidiate and sterile thalli predominating, which is the usual state of affairs for the species on the Cardiganshire coast. Recorded in Locations A, D, I and J.

Opegrapha lithyrga MRCSI NS: rare in rock cavity in outcrop above NW-side of stream in Location B.

Rinodina conradii MRCSI NS: one small patch noted in maritime grassland on dry soil in Location B.

Solenopsora vulturiensis MRCSI: along fissures in rock faces and directly on soil in Location A, locally frequent along rock fissures in sheltered E-facing outcrops above the stream on the NW-side in Location B and very frequent along moist crevices and narrow ledges in Location E. Also in Locations I and J.

Trapeliopsis wallrothii MRCSI: soil in coastal heath in Location B.

Vahliella atlantica MRCSI NR: a few small patches on one soily ledge in the NE-corner in Location A (see Figure 21)

Xanthoparmelia delisei MRCSI NS: c. 7 patches in one area over c. 1 x 0.5 m in Location C and locally very abundant on the upper-middle part of the rock shelf in Location E. See Figure 31.

3.2.2. Other notable species

Absconditella celata NR: one group of c. four ascomata on a pocket of damp, ‘bare’ sandy soil, on a small soily ledge atop the NE-corner of the E-end of the main rock face in Location A (see Figure 21) On account of its tiny size and probable ephemeral nature, this terricolous lichen is almost certainly under-recorded nationally. In VC 46 Cards., several new records of

it have been made for example in recent years from damp soil on inland roadside banks. There is one other coastal record for the VC, from the 1990s on soil on the landward slope of Tanybwlch beach just S of Aberystwyth. In the Aberystwyth area it has also been found on 'bare' soil on a burial plot in the Plas Crug/Llanbadarn Road cemetery and on soil in a shrubbery on the Llanbadarn Fawr college campus.

Acarospora impressula VU NS IR: seen on the dry sides of strainer posts in the fenceline in Location F (with *Myriolecis fugiens*). Apparently not reported on lignum before in Britain.

Agonimia gelatinosa NS: on a compressed, damp, biofilm-like crust of sandy soil on the edge of the rocky area in Location H, confirmed microscopically; the rare or overlooked *A. globulifera* is known in VC46 on the coast nearby at Craig y Gwbert and also on the coast between Trwyn Crou and Ynys-lochtyn, but *A.gelatinosa s. str.* is otherwise known on the coast only on Foel-y-Mwnt.

Arthonia muscigena NS: a dead *Ulex europaeus* stem on a bush in a semi-open patch of mixed *Dactylis glomerata - Pteridium aquilinum - U.europaeus* 'grass-scrub' on the lower edge of the coastal pasture in Location I.

Arthonia varians NS: on apothecia of *Lecanora rupicola* on rock outcrop above maritime grassland in Locations B and H.

Caloplaca arcis NS: very poorly developed, but one fertile patch was seenlarge, low, circular concrete pad, c. 2.5 m (estimated by eye) in diameter, a few inches above ground-level, located in grassland near the cliff top fence directly opposite the island held a range of poorly developed common calcicoles in Location G.

Caloplaca britannica NS IR: rare in Location I, under overhangs on the dry sloping sides of upright rock faces, and directly on thalli of *Hydropunctaria maura* in such niches; the 4th VC46 record. *H.britannica* has been observed inhabiting *H.maura* at other sites on the coast in the VC.

Catillaria flexuosa van den Boom & P. Alvarado (2021) **NEW TO GB**: on north-facing side of a weathered softwood fencepost in Location F, on sea-cliff above rocky shore opposite Cardigan Island, c. 500 m N of Clyn-yr-ynys, GR SN163.513, alt 20 m. Hb. SPC (specimen in herb. v.d. Boom). See Appendix 3 for more details.

Collemopsidium halodytes NS: upper rocky platform and steeply angled upright rock exposures of the lower shore in Location I and occasional on damp rock throughout the littoral zone in Location D.

Dactylospora parellaria NS: on *Ochrolechia parella* in Location I.

Fellhanera bouteillei NS: loose stone by *Ulex* in coastal heath in Location B.

Intralichen lichenum NR: on *Catillaria* sp. in Location F.

Lecanora zosterae NS: on dead *Armeria maritima* bases in the mesic-supralittoral zone in Location D.

Lecania suavis NS: rare below overhangs in Locations I and J.

Lecania atrynoides NS: rare on sloping rock in Location D, with *Lecanora poliophaea*. First record for VC46. Specimen in hb. DML.

Lecanora zosterae NS: on dead *Armeria maritima* bases in the mesic-supralittoral zone in Location D.

Lepraria nivalis NS: soil in Location A, on soil in coastal heath and noted once directly on rock in Locaiton B and on dry soil in Location I.

Scytinium tenuissimum VU (Wales) NS: a small lobelet on sandy soil in Location H.

Sphinctrina tubiformis NR: of special note, a number of thalli of *P.pseudocorallina* in Location K hosted the rare *Sphinctrina tubiformis,* the 1st VC record (hb. SPC).

Stigmidium marinum NR: noted twice on *Wahlenbergiella* (*Verrucaria*) *mucosa*, but probably frequent.

Verrucaria ditmarsica NS: seemingly rare on sheltered rock in the littoral zone, Location D.

Verrucaria prominula NS: common to locally abundant and often codominant with *Hydropunctaria maura* on damp rock in both zones; very fine material making the best locality for the species to date in the VC in Locations D and I.

3.2.3. Description of areas surveyed

Location A

Steep to vertical, mainly N- to W-facing coastal rock faces and associated terricolous soily ledge niches on sea cliff-top above Ogof Filiast, centred on SN1841951728, alt 40m. The rock faces are directly above a high vertical drop into the sea below, and their ‘cliff-let’ form suggests they may perhaps have been quarried for the production of local stone in the past.

Location B

Coastal gully trending SSE-NNW and extending for approximately 150m inland S of Pen yr Hwbyn, centred on SN182516. This distinctive incised topographic feature contains a range of coastal habitats of varying aspects disposed along a maritime gradient. It contains rock exposures, slopes of coastal heath, with *Calluna vulgaris, Erica cinerea* and *Serratula tinctoria* (on the NW-facing side), and maritime grassland (on the SE-facing side), together with a small stream at the bottom above which there are more extensive rock outcrops on the NW-side. The coastal heath vegetation is particularly rich in *Cladonia* species, with a total of 12 recorded. On the NW-side of the gully immediately above the stream, exposures of hard, knife-edged sharp strata have localised freshwater seeps diluting the maritime influence.

Location C

A narrow ledge, c. 1-1.5 m wide, of hard, well-lit rock running along the edge of the high sea-cliff on the cliff top above the first cove feature c. 75 m SW of Pen yr Hwbyn, centred on SN181517. The location holds a good concentration of photophilic, hard rock specialist maritime lichens.

Location D

The lower mesic supralittoral to eulittoral zones around low mean tide level on the end of the Pen yr Hwbyn promontory over the extensive rocky lower shore where the stream enters the sea, centred on SN18245174.

Location E

Extensive, exposed shelving rock platform, sloping north-eastwards down from below the coastal path to the rocky shore W of Pen yr Hwbyn, centred on SN1810751720. The area appeared to have potential, but insufficient time meant it was looked at only briefly and the littoral zone on the rock shore at the bottom was not inspected.

Location F

Softwood posts and rails in the long lengths of fence-line running around the edge of the cliff.

Location G

A large, low, circular concrete pad, c. 2.5 m (estimated by eye) in diameter, a few inches above ground-level, located in grassland near the cliff top fence directly opposite the island which held a range of poorly developed common calcicoles. Possibly just outside the SSSI.

Location H

A small ground-level rock outcrop ringed by thin maritime turf, in pasture close to the cliff-top fenceline opposite Carreg Lydan, at SN1626651349, alt 20m. The ground on and around the outcrop was noticeably trampled, perhaps by people utilizing the spot as a scenic viewpoint. Possibly just outside the SSSI.

Location I

Extensive sloping rocky shore platform and sea-edge cliff beyond, to the N of the cliff-top fenceline, centred on SN16325134.

The upper rocky platform and steeply angled upright rock exposures of the lower shore supported a good range of maritime lichens.

To the E, a high sea stack (‘Mwnt-bach’) shortly offshore in a large cove looked most promising, but was completely inaccessible.

A dead *Ulex europaeus* stem on a bush in a semi-open patch of mixed *Dactylis glomerata* - *Pteridium aquilinum* - *U.europaeus* ‘grass-scrub’ on the lower edge of the coastal pasture above, SN164513, alt 30m,

Location J

Vertical rock faces at the S-end of an inlet, SN164513, some distance away and up from the shore and consequently with a reduced maritime influence. The faces appeared to be the only readily accessible saxicolous habitat associated with the inlet. A few dry rock underhangs were present, but apart from *Opegrapha cesareensis* no significant species were found. Lichen communities were very poorly developed, the majority of crusts being in moribund, often unrecognisable condition, perhaps as a result of invertebrate grazing.

Location K (outside SSSI boundary)

SSE-facing sloping ground-level rock outcrops with associated peripheral, dry maritime grassland*, set in coastal pasture at SN1630551314, alt 14m. Just outside the SSSI.

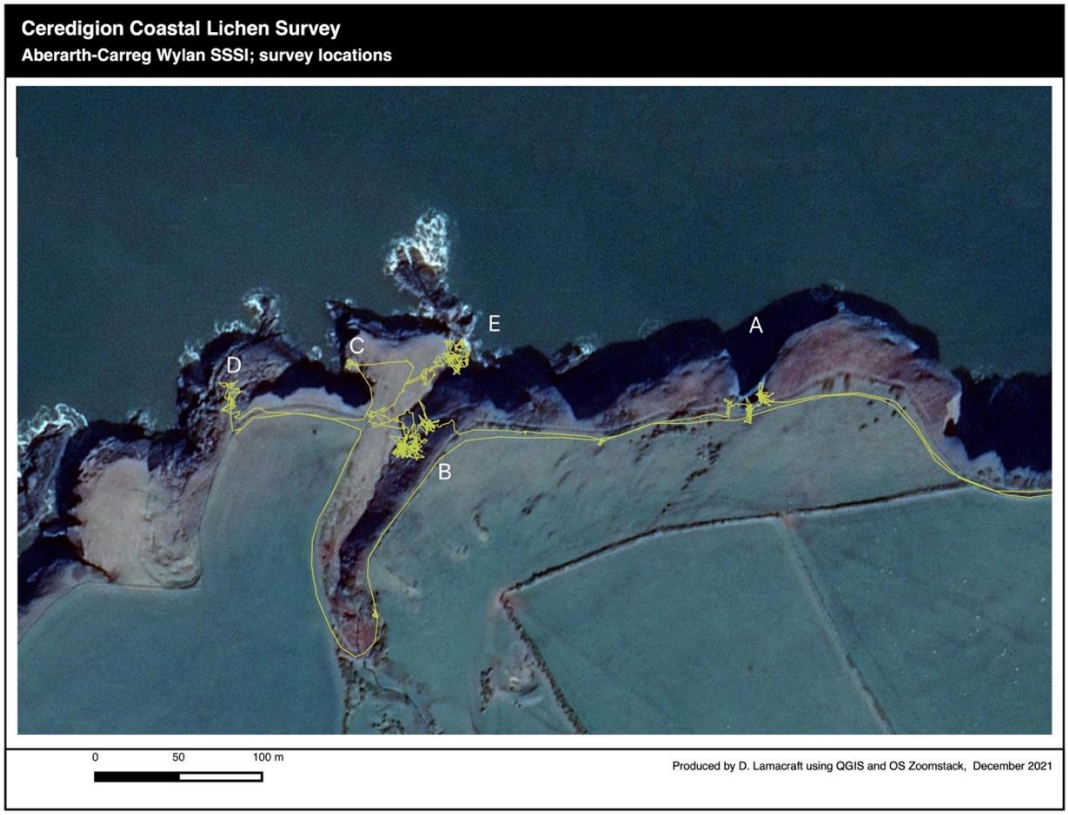


Figure 4. Aberarth-Carreg Wylan SSSI survey locations (Mwnt)

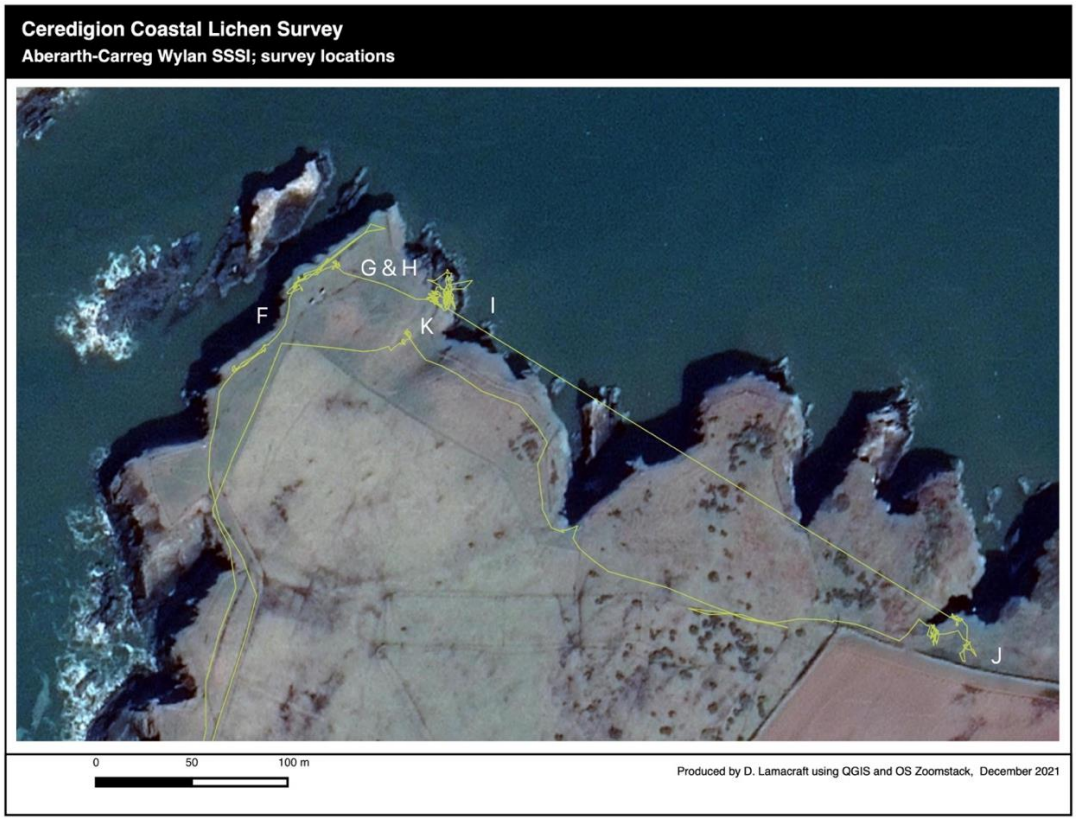


Figure 5. Aberarth-Carreg Wylan SSSI survey locations (Carreg Lydan)

4. Discussion

4.1. Summary of interest

A wide range of notable coastal and maritime lichens were recorded in these brief surveys, and visits to both SSSIs have added significantly to the lists of species known to be present, both MRCSI species and other notable and interesting species.

4.2. Assessment against SSSI Maritime Rock and Coastal Slope Index criteria

'Site selection is based on the number of recorded species or species groupings….over a discrete stretch of coastline less than 5km in length' (Sanderson et al 2018) with the threshold score in this region being 35 i.e. 35 MRCSI species or species groupings.

4.2.1. Borth-Clarach SSSI

This SSSI is around 5km in length and surveys in 2021 focussed on about 600m at the north and south ends. The 2021 survey scores 9 on the MRCSI. Historic records have been provided by S.P. Chambers from his previous visits to the SSSI and from records collated from others which brings the MRCSI score to 14. Using post-2000 records only, which seems an acceptable cut-off for this current assessment, the score would be 12. It seems unlikely that this SSSI would meet the MRCSI threshold even with more survey effort. See Table 1a.

4.2.2. Aberarth-Carreg Wylan SSSI

This SSSI is around 50km in length and surveys in 2021 focussed on about 600m towards the south end of the Ceredigion section. The 2021 survey scores 23 on the MRCSI from this survey alone. Historic records have been provided by Sam Bosanquet (in the specification) and by S.P. Chambers from his previous visits to the SSSI which brings the MRCSI score to 35 with all records considered, or 32 with post-2000 records only. It seems highly likely that this SSSI would reach the MRCSI threshold with further survey effort. See Table 1b.

4.3. Other notable species

A number of other notable species were recorded in both SSSIs, see below. Some taxa were recorded whose identities are unclear, these are discussed in Appendix 3 Taxonomic Notes.

4.3.1. Borth-Clarach SSSI

In addition to the MRCSI species 11 otherwise notable species were recorded including the lichenicolous *Arthonia punctella* on *Diplotomma chlorophaeum* at the north end of the SSSI (2nd Welsh record) and *Scytinium tenuissimum* assessed as Vulnerable on the Wales red list (Woods 2010).

4.3.2. Aberarth-Carreg Wylan SSSI

In addition to the MRCSI species 21 otherwise notable species were recorded, including *Abscontidella celata, Acaraspora impressula, Caloplaca brittanica, Catillaria flexuosa* (new to GB), *Lecania atrynoiodes* (1st record for VC46 Ceredigion) and *Sphinctrina tubiformis* (1st record for VC46 Ceredigion). Also of particular note in the Carreg Lydan area is the richness of the softwood fencing which supported a good range of maritime lichens, some being

recorded only rarely or possibly never before on worked timber in GB e.g. *Acarospora impressula*, *Myriospora fugiens* and *Caloplaca verruculifera*.

4.4. Coverage and future work

These surveys have only really 'scratched the surface', with around 600m of coastline surveyed in each of the SSSIs. Historic records (recent i.e. post 2000 and pre 2000) exist, most made by S.P. Chambers, which cover some of the unvisited areas, but it is certain that more survey work will yield more species. The fact that these short surveys have added 8 new MRCSI species to the relatively well recorded Clarach-Borth SSSI is testament to this.

The Clarach-Borth SSSI is a small section of coast and also better covered by previous visits, but even so another day or two focussing on any more stable sections of cliff along the shoreline would seem worthwhile and likely to yield more MRCSI species. Having said that, it seems unlikely that it woiuld yield enough MRCSI species to reach the qualifying thresholds.

In contrast there is much to go at in the Aberarth-Carreg Wylan SSSI, including the section in north Pembrokeshire, although access to the shoreline is limited and long stretches of the coastal slope on the cliff-top are ungrazed which limits the potential for lichen interest. It would seem very worthwhile to sample other sections of this SSSI in a similar way to the work undertaken here, perhaps aiming to cover a total length of 5km as per the SSSI guidelines, and this seems likely to yield more MRCSI species.

4.5. Habitat management issues

The littoral zones, especially the black and orange, in the areas surveyed seem little impacted by any negative external factors.

More issues exist further up on the coastal slopes. In both SSSIs the areas surveyed had extensive tracts of ungrazed/unmanaged coastal slope resulting in rank homogenous vegetation dominated by e.g. *Pteridium aquilinum, Rubus fruiticosus* agg. and *Ulex europaeus*. This will significantly limit the potential of large sections of these SSSIs to be interest for terricolous and saxicolous lichens. Where the vegetation is more open, perhaps linked to different management, as at Location B in the Mwnt section (see Figures 25-26) areas are rich in terricolous and saxicolous lichens including MRCSI species. More open areas like this are likely to increase the richness of the SSSI for these lichens. There is anecdotal evidence of a trend towards increased 'rankness' e.g. the slope near the Borth war memorial has seen an increase in *Ulex europaeus* and dense grass cover since S. P. Chambers visited in 2000.

'Coastal squeeze' is also in evidence at the Clarach end of this SSSI (Location A), with natural erosion of the soft cliff here leading to re-routing of the coastal footpath slightly further inland. The strip of natural vegetation is therefore only likely to narrow with time, squeezed between the sea and the improved farmland immediately landward. This a prime example supporting the case for a wide 'coastal fringe' of unimproved or natural habitat through which the Wales coast path can pass known in places here this has been discussed for some time e.g. Pen Llŷn as the 'one-field back' idea, the aim being at least one field's width of such land from the cliff top. This would be a more sustainable to approach to the management of the coast path as well as presenting opportunities for nature improvement e.g. it would make the coastal strip more grazeable.

Whilst not necessarily contributing significantly to the MRCSI value (although it does support MRCSI species), softwood fencing does add significantly the general richness of the lichen interest. This is especially the case in Aberarth-Carreg Wylan SSSI where softwood post and

rail fencing at Carreg Lydan supports species only rarely or never previously recorded from this substrate in Britain. This fencing will not last for ever and will presumably be replaced in time, at which point this interest will be lost, although it seems likely it would colonise again over following decades

Table 1a. MRCSI species and scores for Borth-Clarach SSSI (0 indicates not recorded during that period).

	Pre-2021 (SPC)	2021	All
Arthonia phaeobaea	0	1	1
Aspicilia leprosescens	1 (pre-2000 but probably still present)	0	1
Caloplaca cerina var. chloroleuca	0	1	1
Caloplaca maritima	0	1	1
Cliostomum tenerum	1	0	1
Diplotomma chlorophaeum	0	1	1
Lecidella meiococca	1 (pre-2000)	0	1
Leptogium britannicum	1	0	1
Moelleropsis nebulosa	1	0	1
Myriolecis fugiens	0	1	1
Rinodina conradii / intermedia	1	1	1
Solenopsora vulturiensis	0	1	1
Trapeliopsis wallrothii	0	1	1
Vahliella atlantica	0	1	1
MRCSI scores	6	9	12 (score of post-2000 records only)

Table 1b. MRCSI species and scores for Aberarth – Carreg Wylan SSSI (0 indicates not recorded during that period).

	Pre-2021 (NBN)	Pre-2021 (SPC)	2021	All
Arthonia atlantica	1	0	0	1
Arthonia phaeobaea	1	0	0	1
Aspicilia leprosescens	1	1	1	1
Bacidia scopulicola	1	1	1	1
Buellia abstracta	0	0	1	1
Caloplaca littorea	1	1	1	1
Caloplaca maritima	0	1	0	1
Caloplaca sorediella	0	1	1	1
Caloplaca verruculifera	1	1	1	1
Cladonia firma	1 (pre-2000)	0	0	1
Cliostomum tenerum	1	0	1	1
Diploschistes caesioplumbeus	1 (pre-2000)	1	1	1
Diplotomma chlorophaeum	1	0	1	1
Halecania ralfsii	0	0	1	1
Hypotrachyna britannica	0	0	1	1
Lecania aipospila	1	1	1	1
Lecania baeomma	0	0	1	1
Lecania fructigena	1	1	0	1
Lecanora poliophaea	0	1	0	1
Lecidea diducens	1 (pre-2000)	0	0	1
Lecidella meiococca	0	0	1	1
Llimonaea sorediata	0	1	0	1
Moelleropsis nebulosa	1	0	0	1
Myriolecis fugiens	1	0	1	1
Normandina pulchella	1	0	0	1
Opegrapha cesareensis	0	1	1	1
Opegrapha lithyrga	0	0	1	1
Placidiopsis custnani	1	0	0	1
Ramalina canariensis or lacera	1	1	0	1
Rinodina conradii / intermedia	0	0	1	1
Solenopsora holophaea	1 (pre-2000)	0	0	1
Solenopsora vulturiensis	1	0	1	1
Trapeliopsis wallrothii	1 (pre-2000)	0	1	1
Vahliella atlantica	0	0	1	1
*Xanthoparmelia delisei / X. loxodes / X. pulla**	1 (pre-2000)	0	1	1
MRCSI scores	**22**	**13**	**22**	**35 (or 32 with post-2000 records only)**

5. References

British Lichen Society (2021) *Taxon Dictionary* 12/12/2021 <https://www.britishlichensociety.org.uk/resources/lichen-taxon-database>

Dobson, F. S. 2018. *Lichens: An Illustrated Guide to the British and Irish Species*. Richmond Publishing.

Dobson, M.R. *et al.* (1995). The Aberystwyth District. Geologists' Association Guide No. 54.

Fryday, A.M. (1989). Preliminary report of a survey of the lichen flora of Welsh metal mines. Nature Conservancy Council, Aberystwyth.

Gilbert, O.L. (2003). The lichen flora of unprotected soft sea cliffs and slopes, *Lichenologist* **35**(3): 245-254. (May 2003).

Sanderson, N.A., Wilkins, T.C., Bosanquet, S.D.S. & Genney, D.R. 2018. *Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 13 Lichens and associated microfungi.* JNCC, Peterborough.

Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. (eds.) (2009). *The Lichens of Great Britain and Ireland*. London: British Lichen Society.

Vondrák, J. *et al.* (2016). The extensive geographical range of several species of *Teloschistaceae*: evidence from Russia. *Lichenologist* **48**(3): 171-189.

Woods, RG, 2010. A Lichen Red Data List for Wales. Plantlife, Salisbury.

Appendix 1. List of species recorded (modified to comply with Accessibility legislation, but available in full in the PDF saved in the NRW Library and National Library of Wales)

Taxon name	Status
Absconditella celata	LC NR
Acarospora impressula	LC
Acarospora privigna	LC
Agonimia gelatinosa	LC NS
Agonimia tristicula	LC
Alyxoria ochrocheila	LC
Amandinea pelidna	LC
Amandinea punctata	LC
Anaptychia runcinata	LC
Anisomeridium polypori	LC
Arthonia atra	LC
Arthonia calcarea	LC
Arthonia muscigena	LC NS
Arthonia phaeobaea	LC NS
Arthonia punctella	LC NR
Arthonia varians	LC NS
Aspicilia caesiocinerea	LC
Aspicilia calcarea	LC
Aspicilia leprosescens	LC
Bacidia delicata	LC
Bacidia laurocerasi	LC
Bacidia scopulicola	LC
Baeomyces rufus	LC
Brianaria sylvicola	LC
Buellia abstracta	LC NS
Buellia aethalea	LC
Buellia griseovirens	LC
Buellia ocellata	LC
Buellia stellulata	LC ?NS
Caloplaca arcis	LC NS
Caloplaca asserigena	LC NS
Caloplaca brittanica	-
Caloplaca ceracea	LC
Caloplaca crenularia	LC
Caloplaca flavescens	LC
Caloplaca flavocitrina	LC
Caloplaca flavovirescens	-
Caloplaca holocarpa s. str.	LC
Caloplaca littorea	LC NS
Caloplaca marina	LC

Caloplaca maritima	LC NS
Caloplaca microthallina	LC
Caloplaca oasis	LC
Caloplaca sorediella	LC NR
Caloplaca stillicidiorum	LC NS
Caloplaca thallincola	LC
Caloplaca verruculifera	LC
Candelariella aurella f. aurella	LC
Candelariella vitellina f. vitellina	LC
Catillaria chalybeia var. chalybeia	LC
Catillaria flexuosa	NEW GB
Cladonia cervicornis subsp. cervicornis	LC
Cladonia chlorophaea s. lat.	LC
Cladonia diversa	LC
Cladonia fimbriata	LC
Cladonia foliacea	LC
Cladonia furcata subsp. furcata	LC
Cladonia humilis	LC
Cladonia macilenta	LC
Cladonia portentosa	LC
Cladonia pyxidata	LC
Cladonia ramulosa	LC
Cladonia rangiformis	LC
Cladonia squamosa var. squamosa	LC
Cladonia subcervicornis	LC
Cliostomum griffithii	LC
Cliostomum tenerum	LC
Collemopsidium foveolatum	LC
Collemopsidium halodytes	LC NS
Cystocoleus ebeneus	LC
Diploicia canescens	LC
Diploschistes caesioplumbeus	LC NS
Diplotomma chlorophaeum	LC
Enchylium tenax	LC
Endococcus propinquus	LC NS
Enterographa zonata	LC
Fellhanera bouteillei	LC NS
Fuscidea lightfootii	LC
Gyrographa gyrocarpa	LC
Halecania ralfsii	LC NS
Hydropunctaria maura	LC
Hypotrachyna britannica	LC
Hypotrachyna revoluta s. str.	LC
Intralichen lichenum	NE NR
Ionaspis lacustris	LC
Jamesiella anastomosans	LC

Lecania aipospila	LC NS
Lecania atrynoides	LC NS
Lecania baeomma	LC NS
Lecania naegelii	LC
Lecania suavis	DD NR
Lecanora confusa	LC
Lecanora expallens	LC
Lecanora gangaleoides	LC
Lecanora helicopis	LC
Lecanora poliophaea	LC
Lecanora polytropa	LC
Lecanora pulicaris	LC
Lecanora rupicola var. rupicola	LC
Lecanora saligna	LC
Lecanora symmicta	LC
Lecidea fuscoatra s. lat.	-
Lecidea swartzioidea	LC NS
Lecidella asema	LC
Lecidella elaeochroma f. elaeochroma	LC
Lecidella elaeochroma f. soralifera	LC
Lecidella meiococca	LC NS
Lecidella scabra	LC
Lepraria finkii	LC
Lepraria incana s. lat.	-
Lepraria nivalis	LC NS
Leprocaulon microscopicum	LC
Leprocaulon microscopicum	LC
Lichina confinis	LC
Lichina pygmaea	LC
Micarea denigrata	LC
Micarea prasina s. lat.	-
Myriolecis actophila	LC
Myriolecis albescens	LC
Myriolecis dispersa	LC
Myriolecis fugiens	LC
Myriolecis persimilis	LC
Myriolecis zosterae	LC NS
Myriospora smaragdula	LC
Ochrolechia parella	LC
Opegrapha cesareensis	LC
Opegrapha lithyrga	LC NS
Parmelia saxatilis s. lat.	LC
Parmelia sulcata	LC
Parmotrema perlatum	LC
Peltigera canina	LC
Peltigera hymenina	LC

Peltigera membranacea	LC
Peltigera rufescens	LC
Pertusaria lactescens	LC
Pertusaria pseudocorallina	LC
Physcia adscendens	LC
Physcia aipolia	LC
Physcia tenella	LC
Placynthiella icmalea	LC
Porina chlorotica f. chlorotica	LC
Porpidia cinereoatra	LC
Porpidia platycarpoides	LC
Porpidia tuberculosa	LC
Psilolechia lucida	LC
Ramalina cuspidata	LC
Ramalina fastigiata	LC
Ramalina siliquosa	LC
Ramalina subfarinacea	LC
Rhizocarpon geographicum	LC
Rhizocarpon reductum	LC
Rhizocarpon richardii	LC
Rinodina conradii	LC NS
Rinodina oleae	LC
Rinodina sophodes	LC
Sclerococcum parellarium	-
Scoliciosporum chlorococcum	LC
Scoliciosporum umbrinum	LC
Scytinium biatorinum	LC NS Sc
Scytinium palmatum	NT NS Sc
Scytinium tenuissimum	LC NS
Solenopsora vulturiensis	LC
Sphinctrina tubiformis	DD NR
Stigmidium marinum	LC NR
Sytinium teretiusculum	LC L*
Tephromela atra var. atra	LC
Thelenella muscorum var. muscorum	LC
Thelidium minutulum	LC
Toniniopsis aromatica	LC
Trapelia coarctata	LC
Trapelia glebulosa	LC
Trapelia involuta	LC
Trapelia placodioides	LC
Trapeliopsis flexuosa	LC
Trapeliopsis wallrothii	LC
Tylothallia biformigera	LC
Vahliella atlantica	LC NR Sc
Varicellaria lactea	LC

Verrucaria aff. internigrescens	-
Verrucaria ditmarsica	LC NS
Verrucaria fusconigrescens	LC
Verrucaria macrostoma f. macrostoma	LC
Verrucaria mucosa	LC
Verrucaria prominula	LC NS
Verrucaria striatula	LC
Xanthoparmelia delisei	LC NS
Xanthoparmelia verruculifera	LC
Xanthoria aureola	LC
Xanthoria parietina	LC

Appendix 2. Target Notes

The following is from S.P. Chambers' field records with photos by D.M. Lamacraft except where noted.

Clarach – Borth Section (Locations A – D)

Date of Visit: Saturday 25 September 2021

Surveyors: SPC & DML

Location A

Section of coast N from Glan-y-môr, Clarach Bay, N of Aberystwyth, centred on Grid Ref 22(SN)585842. The area of survey extended for approximately 300m N from the beach at Clarach on the N-side of the Afon Clarach.

Investigated habitats comprised –

(i) loose, soft (i.e. undefended glacial till) sea cliffs.
(ii) limited areas of harder rock sea cliffs and rock shelves accessed from the beach.
(iii) dry short coastal cliff-top turf, 'bare' soil lips and dry erosion terracettes locally exposed along the edge of the cliff-top and alongside the coast path.
(iv) a short c. 40 m length of traditional clawdd-type, stone-faced (boulder block) bank alongside the E-side of the coast path immediately above Glan-y-môr.

Species recorded –

Acarospora impressula: poorly developed small thalli along edge of shelving Greywacke layer on hard cliff, on the top of a large boulder at the S-end of the beach and on faces of stone blocks in pathside boulder bank.

***Acarospora privigna* (syn. *Polysporina simplex*)**: on stone block face in pathside boulder bank.

Agonimia tristicula: rare, on soft cliff soil where it was seen fertile once, and sterile on pathside boulder bank soil.

***Amandinea pelidna* (syn. *A.lecideina*)**: very locally frequent along the edge of a sloping exposure above the shore and on block faces in pathside boulder bank.

Amandinea punctata: on small, c. 1 x 1 cm, loose stone on cliff edge bank top.

Buellia aethalea: on boulder inset in ground on cliff top pathside.

Buellia stellulata: small thalli along the well-lit side of a sloping rock outcrop above the shore.

Caloplaca ceracea: occasional to locally frequent on rock, especially on soft-surfaced sloping exposures influenced by windblown soil and sea spray. On one rock shelf thalli were cream-coloured and largely sterile.

***Caloplaca stillicidiorum* (syn. *C.cerina* var. *chloroleuca*)**: rare; one strong patch adjacent to *Rinodina conradii* on narrow band of exposed dry soil on 'bare' lip on cliff edge under *Armeria maritima* and *Plantago maritima* maritime grassland vegetation, SN58571.84328, alt 35 m.

Candelariella aurella: on carbonate mineral (likely ferroan dolomite) in block in pathside boulder bank.

Candelariella vitellina: terricolous directly on consolidated soil on soft cliff, and saxicolous on hard rock cliff.

Circinaria* (*Aspicilia*) *caesiocinerea: occasional on blocks in pathside boulder bank.

Cladonia cervicornis* ssp. *cervicornis: dry soil on cliff top bank and on cliff edge.

Cladonia fimbriata: rare on soil on pathside boulder bank.

Cladonia foliacea: dry basic soil on pathside boulder bank.

Cladonia humilis: rare on dry soil on ledge on soft cliff.

Cladonia macilenta: rare on dry soil on cliff top path edge.

Cladonia pyxidata: locally frequent on soft cliff soil. Often epodetiate and occurring as small groups of non-descript squamules.

Cladonia rangiformis: in NVC U1-type vegetation on dry top of pathside boulder bank and on soil on cliff edge.

Diplotomma chlorophaeum: occasional on hard cliff rock exposures above beach.

Enchylium* (*Collema*) *tenax* var. *tenax: rare on basic soil on soft cliff face. [note: the rare *E.limosum* is known from the Cardiganshire coast at Llanina Point at the E end of New Quay Bay].

***Flavoplaca* (*Caloplaca*) 'aff. *flavocitrina*'**: on soil on soft cliff. This entity occurs moderately frequently on stabilised soil on soft sea cliffs of glacial till on the Cardiganshire coast. Outwardly it appears identical to *F.flavocitrina*, a species known to have a very broad ecological range, and is likely to be that taxon, but members of the group can only be identified with certainty by molecular barcoding of ITS sequences (Vondrák *et al.* 2016).

Flavoplaca* (*Caloplaca*) *maritima: rare, on soily sloping rock face at foot of hard rock cliff, GR (GPS) 22(SN)58596.84180.

Hydropunctaria* (*Verrucaria*) *maura: occasional in the littoral zone at the base of hard rock exposures.

Lecanora fugiens: on block face in pathside boulder bank.

Lecanora helicopis: rare, on block in pathside boulder bank.

Lecanora polytropa: rare, on block in pathside boulder bank.

Lecanora zosterae: rare, growing near *Rinodina conradii* on narrow band of exposed dry soil on 'bare' lip on cliff edge under *Armeria maritima* and *Plantago maritima* maritime grassland vegetation, SN58571.84328, alt 35 m.

Lecidea fuscoatra: on block face in pathside boulder bank.

Lecidea swartzioidea: rare, one thallus on face of stone block in pathside boulder bank.

Lecidella scabra: block faces in pathside boulder bank.

Lepraria finkii: on moist soil on soft cliff.

Lepraria nivalis: dry soil faces on soft cliff, often below vegetated ledges with mats of *Silene uniflora.*

Micarea prasina s. lat.: on soil on bank on cliff top.

Myriospora smaragdula: rock crevices on hard cliff slope above shore.

Ochrolechia parella: hard cliff rock exposures.

Peltigera canina: rare, in short, *Thymus drucei*-rich turf on top of rabbit grazed bank on cliff top beside coast path.

Peltigera hymenina: rare, on acid soil on top of pathside boulder bank.

Physcia adscendens: on nutrient-enriched surfaces on hard rock cliff.

Physcia tenella* ssp. *marina: the coastal rock ecotype, occasional on hard rock above the shore. Now generally dismissed, subsp. *marina* at least on the Cardiganshire coast appears distinctive and merits recording at whatever rank for ecological if not taxonomic reasons.

Ramalina siliquosa: rare, one small tuft on face of stone block in pathside boulder bank.

Rhizocarpon geographicum: rare on block face on pathside boulder bank.

Rhizocarpon reductum: on boulder inset in ground on pathside on cliff top.

Rhizocarpon richardii: rare on stone block faces in pathside boulder bank.

Rinodina conradii: rare, on narrow band of exposed dry soil on 'bare' lip of cliff edge under *Armeria maritima* and *Plantago maritima* maritime grassland vegetation, SN58571.84328, alt 35 m.

Rinodina oleae: present as the saxicolous '*R.gennarii*-ecotype', on enriched hard rock above the shore.

Scoliciosporum umbrinum: block faces in pathside boulder bank.

Scytinium* (*Leptogium*) *biatorinum: in very small quantity on damp soil (fine argillaceous soil - rock crumb matrix) on soft cliff. Mostly present as minute proto-globules.

Scytinium* (*Leptogium*) *tenuissimum: rare on dry soil on ledges on soft cliff and on pathside boulder bank.

Tephromela atra: on faces of blocks in pathside boulder bank.

Thelidium minutulum: rare (collected once), on small lump of consolidated soil on soft cliff.

Variospora* (*Caloplaca*) *flavescens: on carbonate mineral (likely ferroan dolomite) in otherwise siliceous block in pathside boulder bank.

Verrucaria fusconigrescens: on shelving outcrop of hard rock, mostly along the sides of cracks and cleavages where sea water drains down, and on block faces in pathside boulder bank.

Wahlenbergiella* (*Verrucaria*) *mucosa: rare, on sheltered hard rock in the eulittoral.

Xanthoria parietina: small fragmentary thalli (lobules) on hard rock exposure above shore.

Figure 6. Glacial till ‘soft cliff’ at Glan-y-môr, Clarach. S. P. Chambers for scale.

Figure 7. Sloping rock exposure with *Amandinea pelidna*, *Buellia stellulata* amongst other common maritime rock species.

Figure 8. The clawdd (traditional stone-faced earth bank boundary) at Glan-y-môr, Location A.

Overview of historic records

The sea cliff between Clarach and Wallog was first visited for lichens by Alan Fryday (AMF) in February 1989 when he was staying in Borth during his visit to Ceredigion to survey metal mines (Fryday 1989), probably at the suggestion of the then NCC District Officer Dr Glyn Jones, who was keen to make use of the time available for additional lichen survey in the district. A BLS recording card and a very short summary of the visit is contained in the back of his metal mine report (Fryday 1989). SPC has the only apparently surviving copy of the original report in his library (pers. comm. AMF, c. 2001). AMF's summary unfortunately does not provide precise locations for the rare species he recorded, notable among which were *Arthonia ligniariella* ('on bare soil on cliff top'), *Gyalecta biformis* ('in a rock crevice'), 'a small *Leptogium* sp.' (almost certainly this will likely have been *Scytinium tenuissimum*), *Peltigera canina s. str.* ('from near the Borth end' [also recorded in 2021]) and *Rinodina conradii* ('on erosion overhang near Clarach' [still present in 2021]). AMF also later unearthed a specimen of *Lecidella meiococca* 'in a *L.scabra* packet' (pers comm. March 1996). Since the 1990s the cliff edge zone has undergone a moderate amount of 'coastal squeeze' narrowing due to progressive recessional erosion of the soft glacial till sea cliffs. The author estimates that a width of c. 3 – 5 metres has been lost in total over the last c. 30 years. However, the soft cliff edge habitat remains essentially unaltered in terms of niche availability and all the notable species recorded historically are highly likely to still be present. The current survey was not ideally timed in respect of detecting the more ephemeral and probably seasonal taxa, such as the terricolous *Arthonia* species.

Since November 1990, SPC has visited the cliffs and cliff-tops to survey the lichens in wintertime on at least four occasions. Notable species recorded on the visits include *Arthonia*

lignaria (on algal biofilm on damp soil on the edge of the cliff), 'terricolous *Myriospora* (*Acarospora*) *smaragdula'* [considered by some lichen taxonomists to be a distinct species, *A.benedarensis,* and recently transferred on molecular evidence to the genus *Trimmatothelopsis* as *T.benedarensis*], *Caloplaca stillicidiorum* (on a decaying *Armeria maritima* tuft; re-found in 2021) and similarly apparently terricolous examples of *Polysporina simplex* (now *Acarospora privigna*) unless these too eventually prove to be another cryptic taxon. On the stone bank beside the coast path the maritime saxicoles *Aspicilia leprosescens* and *Lecidella asema* were recorded in 1994. They are highly likely to still be present, as the bank like the cliff top is essentially unchanged if perhaps a touch more trampled by foot pressure following the establishment of the official Wales Coast Path route. Also in 1994, SPC recorded terricolous *Candelariella vitellina*, the rare *Polyblastia agraria* ('on the edge of a decaying lump of cliff-top soil c. 200m N of Glan-y-môr'), *Thelocarpon laureri* (conf. Dr B.J. Coppins; hb. SPC; fruiting abundantly on dry soil on the vertical side of an eroded face under a soily overhang, and also occurring lichenicolously on terricolous *Trapelia involuta s. str.*), as well as material of a possibly undescribed *Pyrenocollema* sp. (now *Collemopsidium*) similar to collections from the Cardiganshire metal mines. On a visit in 1995 the citrine green chemotype of *Candelariella vitellina*, f. *flavovirella*, was found growing with the typical yellow form on the vertical E-side of a boulder on the landward side of the boulder bank. In 2003 fertile *Moelleropsis nebulosa* (now *Fuscopannaria*) and *Thrombium epigaeum* were recorded on cliff-top soil, and *Cliostomum tenerum* on a boulder in the sea cliff towards the Wallog end. This time series demonstrates that good lichen sites do not necessarily yield all their species on one or two visits but instead require repeat visits over many years in order to obtain a fuller picture of their true richness.

Location B

A small extent of N to NE-facing, steeply sloping rock exposures (some possibly formed by past small-scale local stone quarrying) and associated terricolous habitats on the cliff top a few metres distant from the coast footpath, centred on GR22(SN)601887, alt 40-50m, c 100 – 250m NE of the War Memorial W of Upper Borth. The location had been surveyed previously by SPC on 5/7/2015.

Well-develop maritime lichen communities were absent with only a few species of coastal affinity occurring (shown **emboldened**), the communities present being types more typical of sheltered acid inland rock, probably on account of the sheltered aspect of the rock faces with regard to the prevailing maritime influence, their height above and away from the main Craig yr Wylfa sea cliffs, and their likely fairly recent anthropogenic origin.

<u>Species recorded –</u>

Baeomyces rufus, Cladonia pyxidata (dry bank), *Cystocoleus ebeneus* (dry, sheltered underhang)*, Enterographa zonata* (dry face), *Gyrographa* (*Opegrapha*) *gyrocarpa* (fertile, on rain-sheltered face), *Lecidella scabra, Lepraria incana,* ***Ochrolechia parella*** (rare, thalli mostly heavily radulated by molluscs), *Parmelia saxatilis,* ***Peltigera canina*** (dry basic grassland on top of one outcrop), *P.hymenina* (acid grassland), *P.membranacea* (mesotrophic maritime grassland), *Porpidia cinereoatra,* ***P.platycarpoides****, P.tuberculosa* (with *Endococcus propinquus*)*, Pertusaria pseudocorallina, Psilolechia lucida* (dispersed morph on dry face), ***Rhizocarpon richardii*** (rare), ***Scytinium tenuissimum*** (rare; on dry soil on bank), ***Solenopsora vulturiensis*** (rare, in crevice), *Trapelia involuta s. str.,* ***Trapeliopsis wallrothii*** (rare; on consolidated soil of anthill) and *Varicellaria* (*Pertusaria*) *lactea* (locally frequent on two rock faces).

In addition, on a ± N-facing damp acid shale face, an unidentified sterile sorediate crust was present, somewhat resembling a depauperate saxicolous *Mycoblastus caesius* (see Taxonomic Notes) having a light grey, thin thallus with a very slight blue-grey tinge and

discrete, soft pale greenish soralia (soredia c. 20 – 30 µm diam.), Pd-, K+ strong yellow (on white filter paper), KC-, C-, UV+ white.

Additional species recorded from the same locality in 2015 by SPC include *Candelariella vitellina, Diploschistes scruposus* (rock crevice)*, Myriospora smaragdula, Ochrolechia androgyna, Physcia adscendens* and *Rhizocarpon reductum.*

Figure 9. The cliff below Borth war memorial, taken from the rock exposures at Location B.

Figure 10. Looking north towards Borth war memorial, visible centre skyline, from the coast between Locations B and C.

Location C

W-SW-facing, sparsely vegetated steep (c. 30-40 degrees) rocky slope directly above the landward side of the coastal path steps where it descends to the Brynrodyn covelet on the shore, c. 650 m SW of Upper Borth, centred on GR (GPS) 22(SN)60029.88210, alt c. 25-35 m. The upper part of the slope is cloaked in *Ulex europaeus* scrub and the lower open rock and soil habitats carry pronounced maritime-character plants, including *Silene uniflora.*

Most of the small central open part of the slope comprised crumbly to semi-stable rock surfaces and dry soil dominated by epigaeic and saxicolous cryptogams. The slope had a rich lichen flora with a number of interesting species (**shown emboldened**) present, including *Cladonia cervicornis* ssp. *cervicornis,* ***C.foliacea****, C.furcata* ssp. *furcata, C.rangiformis,* ***Leprocaulon microscopicum*** (soily crevices), *Parmelia saxatilis, Parmotrema perlatum* (rare, one small thallus on rock), ***Pertusaria lactescens*** (very locally frequent on an inclined, fractured rocky slope), ***Scytinium* (*Leptogium*) *palmatum*** (rare, seen once), ***S.tenuissimum***, ***Solenopsora vulturiensis****,* ***Thelenella muscorum* var. *muscorum*** (c. three patches investing acrocarpous bryophytes in one place on the SW-facing lower part), ***Trapeliopsis wallrothii*** (frequently fertile numerous thalli on dry soil – noted only sterile here by SPC in 2000) and ***Vahliella atlantica*** (at least four good patches, the largest to c. 3 x 4 - 5 cm across, on consolidated dry acid soil on the middle part of the slope).

A similar coastal slope, but on a drier SSW-facing aspect and slightly more calcicolous in character, immediately above the beach to the W of the coast path had ***Cladonia foliacea****,* ***Lecanora zosterae*** (dead plant bases), ***Peltigera rufescens*** (rare), ***Scytinium* (*Leptogium*) *teretiusculum*** (saxicolous on a loose fragment of rock), ***Solenopsora vulturiensis*** and ***Thelenella muscorum* var. *muscorum*** (seen twice over bryophyte cushions).

Historic Visits

SPC has recorded on the coastal slopes SW of the Borth War Memorial on a number of occasions since 2000. VC-notable vascular plants worthy of mention here in respect of ecological affinities include *Carex arenaria* (seen on 2021 survey visit) and *Moenchia erecta.* The stonework of the plinth of the memorial itself is notable for supporting large quantities of *Acarospora impressula*, the combined thalli of which represent perhaps the largest single population of the species in the Vice-county and perhaps on the mid-Wales coast. On a visit on 22 April 2000, fertile *Agonimia tristicula* was seen growing directly on dry soil on the vertical wall of a rabbit burrow entrance. The main coastal slope below (southwest of) the memorial at that time was occupied largely by rabbit-grazed maritime grassland and had only scattered small *Ulex europaeus* bushes [SPC photographic archive Kodachrome colour slide 3 box 82 (slide 3/82/00)], but by 2021 *U.europaeus* had increased considerably, probably as a result of a decline in overall rabbit numbers and consequent reduction in grazing pressure. The edge of the cliff here is rather dangerous to explore safely, as it has an overhanging, cornice-like edge-lip of eroding soil projecting out from the cliff, but *Rinodina conradii* and scattered tufts of *Leptogium britannicum* growing in short *Thymus*-rich vegetation on the soil lip were recorded in 2000. The area was inspected cursorily in 2021 and although *Ulex europaeus* was more in evidence both lichens are likely to still occur on the open cliff edge soil.

Figure 11. *Trapeliopsis wallrothii* on dry shaley soil at Location C.

Figure 12. The dry bank above the coastal path with a good population of *Trapeliopsis wallrothii*.

Figure 13. A photo of the habitat supporting several patches of *Vahliella atlantica* below the GPS in open dry shaley soil in Location C.

Figure 14. *Vahliella atlantica* (dark blue-grey patch in centre), Location C.

Figure 15. Some of the habitat in Locaiton C – dry open shaley soil amongst patches of *Ulex europaeus*.

Figure 16. A typical patch of open habitat in Location C.

Location D

A short length of sea cliff running for approximately 200 m S from GR SN599882 to SN599880

within the tetrad. In comparison to the length to the N (Craig yr Wylfa in SN68 Tetrad E) previously surveyed by SPC in July 2015, the sea cliff appeared at least in sections far less eroded, possibly on account of the Silurian strata although of similar relative softness being more protected here from south-westerly storms than the very exposed Carreg Mulfran – Craig yr Wylfa section. Sections towards the far S-end however appeared more eroded at least as viewed from distance. The sea cliffs here form part of the Borth Mudstones Formation in the Llandovery Series of the Silurian and their fragile nature and vulnerability to marine erosion is recognised by geologists (Dobson *et al.* 1995).

Species recorded -

***Arthonia* (*Opegrapha*) *calcarea* (syn. *Opegrapha saxatilis*)**: rare to occasional on sheltered dry faces in the lower mesic-supralittoral zone. A range of forms were present, including **'*O.conferta*-type'** morphs with heaped lirellae.

Arthonia phaeobaea: very rare, a single small sterile (pycnidiate) thallus seen on the face of a hard Greywacke layer in the upper mesic-supralittoral zone a few metres away from *A.punctella* (see below).

***Arthonia punctella*:** seen in very small quantity on c. three *Diplotomma chlorophaeum* thalli on the well-lit, dry face of a hard Greywacke layer, c. 10m up on an accessible part of sea cliff at GR (GPS) 22(SN)59956.88143. The 2nd VC & Welsh record and the 1st on *D.chlorophaeum*.

Catillaria chalybeia: frequent but often poorly developed on smooth rock in the mesic-supralittoral zone.

Collemopsidium halodytes: occasional in the upper littoral – lower mesic-supralittoral zone on hard Greywacke faces, often occurring on superficially 'bare' spaces over smooth, damp rock between dispersed thalli of *Hydropunctaria maura.*

Diplotomma chlorophaeum: generally sparse but in local concentrations on the harder faces of sandstone Greywacke units in the mesic-supralittoral zone.

Flavoplaca* (*Caloplaca*) *marina: quite scarce and poorly developed on harder rock faces in the lower mesic-supralittoral zone.

Flavoplaca* (*Caloplaca*) *microthallina: occasional in the lower mesic-supralittoral zone.

Hydropunctaria* (*Verrucaria*) *maura: locally frequent on harder rock surfaces in the littoral and lower mesic-supralittoral zones on more sheltered north-facing aspects.

Lecanora actophila: rare on west-facing Greywacke layers in the mesic-supralittoral zone.

Lecanora helicopis: very sparse on damper Greywacke layers in the mesic-supralittoral zone.

Lichina confinis: occasional to locally frequent, often investing *Hydropunctaria maura* on sheltered aspects in the upper littoral zone, and seen fertile on a number of occasions.

Ramalina siliquosa: very rare, a single small weak tuft seen on one Greywacke face.

Rhizocarpon reductum: rare on hard face in the upper mesic-supralittoral zone.

***Rinodina oleae* (saxicolous '*gennarii*' ecotype)**: frequent on faces enriched by sea spray in the mesic-supralittoral zone.

Toniniopsis* (*Toninia*) *aromatica: rare to occasional, growing chasmolithically in rock fissures in the middle to upper mesic-supralittoral zone.

Variospora* (*Caloplaca*) *thallincola: occasional small thalli in the lower mesic-supralittoral.

Verrucaria prominula: rare, on moist faces and along fissure edges in the middle mesic-supralittoral zone.

Xanthoria aureola: occasional fragmentary thalli in the lower mesic-supralittoral.

Xanthoria parietina: occasional small thalli in the lower mesic-supralittoral.

Of most note is the presence of *Arthonia punctella* - entry prepared for NRI Bull. 130 Summer 2022: ***Arthonia punctella***: on *Diplotomma chlorophaeum* on well-lit face of Greywacke layer in Silurian mudstone sea-cliff, c. 300 m southwest of Brynrodyn, Upper Borth, GR SN599.881, alt 10 m, September 2021. Herb. SPC. The 2nd Vice-county & Welsh record. S.P. Chambers & D.M. Lamacraft

Mwnt – Pen yr Hwbyn Section (Locations A – E)

Date of Visit: Wednesday 6 October 2021

Surveyors: SPC & DML

Field fence and pathside softwood posts and fence rails either side of the coastal path: *Amandinea punctata, Buellia griseovirens, Caloplaca asserigena* (rare, seen on the curved face of one fence rail)*, Fuscidea lightfootii, Lecanora expallens, L.saligna, Lecidella elaeochroma* f. *elaeochroma, Micarea denigrata* (mesoconidial anamorph), *Parmelia sulcata, Physcia tenella, Rinodina oleae* (*R.gennarii*-ecotypes), *Scoliciosporum chlorococcum, Trapeliopsis flexuosa* & *Xanthoria parietina* (small lobules). The sterile pycnidiate anamorph of *Brianaria* (*Micarea*) *sylvicola* was seen on the dank sheltered dry side of one fencepost. The anamorphic state of *B.sylvicola* is occasional on fenceposts inland in Cardiganshire, but is rare on the coast.

Epiphytes of *Ulex europaeus* bushes in patches of sea cliff-top scrub included *Bacidia laurocerasi, Bacidina delicata* (seen fertile once), *Parmotrema perlatum* & *Physcia tenella.*

Siliceous stone slab on old field bank: *Amandinea pelidna, Athallia* (*Caloplaca*) *holocarpa s. str.* (nutrient-enriched top), *Candelariella vitellina, Diploicia canescens* (dry E-side), *Lecidella scabra* & *Porina chlorotica* (shaded E-side).

Figure 17. The coast between Mwnt and Locaiton A, dominated by rank typical coastal vegetation with little open habitat and no access to the hard rock cliff below.

Location A

Steep to vertical, mainly N- to W-facing coastal rock faces and associated terricolous soily ledge niches on sea cliff-top above Ogof Filiast, centred on GR (GPS) 22(SN)18419.51728, alt 40m. The rock faces are directly above a high vertical drop into the sea below, and their 'cliff-let' form suggests they may perhaps have been quarried for the production of local stone in the past.

Species Recorded -

Absconditella celata: one group of c. four ascomata on a pocket of damp, 'bare' sandy soil, on a small soily ledge atop the NE-corner of the E-end of the main rock face. On account of its tiny size and probable ephemeral nature, this terricolous lichen is almost certainly under-recorded nationally. In VC 46 Cards., several new records of it have been made for example in recent years from damp soil on inland roadside banks. There is one other coastal record for the VC, from the 1990s on soil on the landward slope of Tanybwlch beach just S of Aberystwyth. In the Aberystwyth area it has also been found on 'bare' soil on a burial plot in the Plas Crug/Llanbadarn Road cemetery and on soil in a shrubbery on the Llanbadarn Fawr college campus.
Agonimia tristicula: rare on soil
Alyxoria* (*Opegrapha*) *ochrocheila: on dead stem base of *Plantago maritima*
Amandinea pelidna: rock faces
Anaptychia runcinata: rock faces, seen fertile
Anisomeridium polypori: on dead *Plantago maritima* stem base
Arthonia* (*Opegrapha*) *calcarea: mostly as '*O.conferta*-morphs' on rock faces
Blastenia* (*Caloplaca*) *crenularia: rock face
Caloplaca ceracea: rock face
Candelariella vitellina: rock faces
Catillaria chalybeia: rock faces, including morphs with atypically large apothecia and well-developed thalli. They may represent a separate taxon.
Cladonia foliacea: rare on dry soily ledge
Cladonia furcata: acid soil on ledge
Cladonia pyxidata: soil
Cladonia rangiformis: dry soil on ledge
Cladonia subcervicornis: a few squamules in damp crevice irrigated by freshwater
***Gyalecta* sp.**: c. four tiny, c. 0.15 mm diam., apothecia nestling in a vertical crack running down the upper part of a W-facing rock face by the NE corner of the cliff-let, in a practically uncollectable position without endangering the integrity of the face. An attempt was made to collect a specimen but the resulting 'pinch' sample of powdered rock fragments and dust proved not to contain any apothecia when later examined under stereo-binocular microscope. It may have been one of the rare coastal species, either *G.biformis* (recorded from Clarach) or *G.foveolaris* (recorded from Foel y Mwnt), but equally it could also have been the common and predominantly epiphytic *G.truncigena* which has recently been found on rock on the Cards coast at Cwmtydu.
Gyrographa* (*Opegrapha*) *gyrocarpa: dry overhung rock face
Hydropunctaria maura: base of damp E-facing rock face
Ionaspis lacustris: on moist freshwater seep on E-facing rock face
Lecania baeomma: locally frequent, often extensively spreading, diffuse and mostly highly abraded, sorediate thalli, growing on sub-vertical, N-facing rock faces. Sterile, but fertile thalli were observed in c. four places with apothecia restricted to the more coherent and less abraded parts of thalli, on two rock faces. Soralia on abraded thalli were grey-yellow to pale grey-green in colour, lacking the usual characteristic inky-grey-blue speckling. The 1st VC 46 record. Voucher specimen in hb. SPC.
Lecanora polytropa: rock faces
Lecidella meiococca: rare on rock faces. One sterile patch c. 3 x 1.5cm
Lecidella scabra: rock faces
Lepraria nivalis: soil

Leprocaulon microscopicum: sheltered crevice on rock face
Myriospora smaragdula: crevices in rock face
Ochrolechia parella: rock faces
Opegrapha cesareensis: dry rock faces under overhangs. Pycnidiate and sterile thalli predominating, which is the usual state of affairs for the species on the Cards coast.
Pertusaria lactescens: rock face
Pertusaria pseudocorallina: rock faces
Porpidia cinereoatra; rock faces
Porpidia platycarpoides: rock faces and spreading on to soil
Porpidia tuberculosa: rock faces
Ramalina siliquosa: rock faces
Rhizocarpon reductum: rock faces
Rhizocarpon richardii: rock faces
Scoliciosporum umbrinum: rock faces
Solenopsora vulturiensis: along fissures in rock faces and directly on soil
Tephromela atra: well-lit W-facing rock face
Trapelia involuta s. str.: rock face and soil
Vahliella atlantica: a few small patches on one soily ledge in the NE-corner
Verrucaria fusconigrescens: rock face
***Verrucaria* 'aff. *internigrescens*'**: rock face. This species is perhaps not correctly reported from Britain and material currently placed under the name might not be that taxon (pers. comm, A. Orange)

Softwood fenceposts and fencepost strainer: *Cliostomum griffithii* (pycnidiate form on dry E-sides), *Hypotrachyna revoluta, Lecanora confusa, L.pulicaris, L.symmicta, Physcia aipolia, P.tenella* (fertile), *Ramalina fastigiata* and *R.siliquosa* (colony on exposed side)

Pathside boulder: *Lecidella scabra* (fertile), *Parmotrema perlatum, Ramalina subfarinacea, Xanthoria aureola* and *X.parietina.*

Figure 18. The rock exposures at Location B, with S. P. Chambers by the exposure supporting frequent *Lecania baeomma*.

Figure 19. The easternmost face with a range of interesting terricolous species on the soil/rock interface including *Vaheliella atlantica* and *Abscontidella celata*.

Figure 20. *Abscontidella celata* visible (just!) as tiny orange-red dots in the centre of the photo amongst the moss, Location A.

Figure 21. *Vahliella atlantica*, Location A.

Figure 22. *Lecidella meiococca*, Location A.

Figure 23. *Lecania baomma*, Locaiton A; scattered blue-grey soredia and blue-grey pruinose apothecia with a clotted cream coloured lumpy and sorediate thallus.

Figure 24. *Lecania baomma*, Location A.

Location B

Coastal gully trending SSE-NNW and extending for approximately 150m inland S of Pen yr Hwbyn, centred on GR22(SN)182516. This distinctive incised topographic feature contains a range of coastal habitats of varying aspects disposed along a maritime gradient. It contains rock exposures, slopes of coastal heath, with *Calluna vulgaris, Erica cinerea* and *Serratula tinctoria* (on the NW-facing side), and maritime grassland (on the SE-facing side), together with a small stream at the bottom above which there are more extensive rock outcrops on the NW-side. The coastal heath vegetation is particularly rich in *Cladonia* species, with a total of 12 recorded. On the NW-side of the gully immediately above the stream, rock exposures of hard, knife-edged sharp strata have localised freshwater seeps diluting the maritime influence.

Species Recorded –

Arthonia* (*Opegrapha*) *calcarea: dry underhangs on E-facing rock face on NW side
Arthonia varians; on apothecia of *Lecanora rupicola* on rock outcrop above maritime grassland
Baeomyces rufus: soil in coastal heath
Buellia abstracta: on a small, c. 3 x 1 cm, stone lying loose on southeast-facing slope of maritime grassland below crest at the top NW-end, SN181517, alt 25m (see fig. 1). The fourth VC-record and a new hectad record (SN15). Herb. SPC.
Buellia ocellata: pathside boulder
Candelariella vitellina: pathside boulder
Catillaria chalybeia: sheltered outcrops above stream
Cladonia cervicornis* ssp. *cervicornis: coastal heath and slope of maritime grassland. Seen fertile.
Cladonia chlorophaea s. lat. : coastal heath
Cladonia diversa: coastal heath
Cladonia foliacea: rare on a rocky area in the coastal heath and occasional in dry maritime grassland
Cladonia furcata: coastal heath
Cladonia humilis: rare on dry soil in coastal heath
Cladonia macilenta: rare in coastal heath
Cladonia portentosa: rare in coastal heath
Cladonia pyxidata: coastal heath
Cladonia ramulosa: coastal heath
Cladonia rangiformis: coastal heath and maritime grassland
Cladonia squamosa* var. *squamosa: rare in coastal heath
Diploicia canescens: rare on dry rock face above maritime grassland
Diplotomma chlorophaeum: rare on outcrop above maritime grassland
Fellhanera bouteillei: loose stone by *Ulex* in coastal heath
Gyrographa* (*Opegrapha*) *gyrocarpa: sheltered rock face above stream
Hydropunctaria maura: damp sheltered rockfaces above the stream
Hypotrachyna britannica: a few thalli on one NW-sloping rock exposure in heath
Jamesiella anastomosans: dead *Calluna* stem
Lecanora confusa: dead *Calluna* stem
Lecanora expallens: dead *Calluna* stem
Lecanora fugiens: pathside boulder
Lecanora gangaleoides: rock slope in coastal heath and on outcrop above maritime grassland
Lecanora helicopis: pathside boulder
Lecanora polytropa: rock outcrop by coastal path
Lecanora rupicola: rock outcrop above maritime grassland
Lecidea fuscoatra: rock outcrop by coastal path
Lecidella meiococca: rare on rock outcrop. Seen fertile once.

Lepraria nivalis: soil in coastal heath and noted once directly on rock
Opegrapha cesareensis: rare in dry rock recesses above NW-side of stream
Opegrapha lithyrga: rare in rock cavity in outcrop above NW-side of stream
Parmelia sulcata: rare on bedrock in coastal heath
Parmotrema perlatum: one small thallus on rock in heath
Peltigera hymenina: rare in coastal heath
Pertusaria pseudocorallina: rock outcrops in heath
Physcia adscendens: pathside boulder
Physcia tenella: pathside boulder
Placynthiella icmalea: coastal heath
***Porina chlorotica* agg.**: rare, on sheltered damp vertical side of outcrop in coastal heath. [Note: *P.chlorotica* is now known to comprise a collective of some c. four cryptic phylogenetic taxa]
Porpidia cinereoatra: rock slope
Porpidia platycarpoides: rock slope in heath and on outcrops above maritime grassland. Mostly occurring as pycnidiate scurfy pale brown-fawn morphs lacking apothecia
Ramalina cuspidata: single tuft on rock outcrop above maritime grassland
Ramalina siliquosa: rock outcrop above maritime grassland. Seen fertile.
Rhizocarpon richardii; rock slope
Rinodina conradii: one small patch noted in maritime grassland on dry soil
Solenopsora vulturiensis: locally frequent along rock fissures in sheltered E-facing outcrops above the stream on the NW-side
Tephromela atra: on outcrop above maritime grassland. In one place seen abutting thalli of *Lecanora gangaleoides*
Trapelia coarctata s. str. : damp nook in rock outcrop in coastal heath
Trapelia involuta s. str. : rock slope
Trapelia placodioides: rock slope
Trapeliopsis wallrothii: soil in coastal heath
Tylothallia biformigera: rare on NW-facing rock slope in coastal heath
Verrucaria fusconigrescens: rock slope
Verrucaria prominula: rare on sheltered outcrop above stream
Xanthoparmelia verruculifera: rock outcrop by coastal path at head of gully at GR(GPS)22(SN)18192.51595.

Figure 25. The gully at Location B, with open coastal heath to the left foreground, a rock outcrop above a stream centre left, and hard rock maritime rock to the right (the latter is Location D).

Figure 26. Looking south up the gully from above the shore, with the open *Cladonia*-rich coastal heath visible on the upper slope left and rock outcrop centre right.

Figure 27. Example of the open coastal heath habitat in Location B with a good terricolous and saxicolous lichen flora.

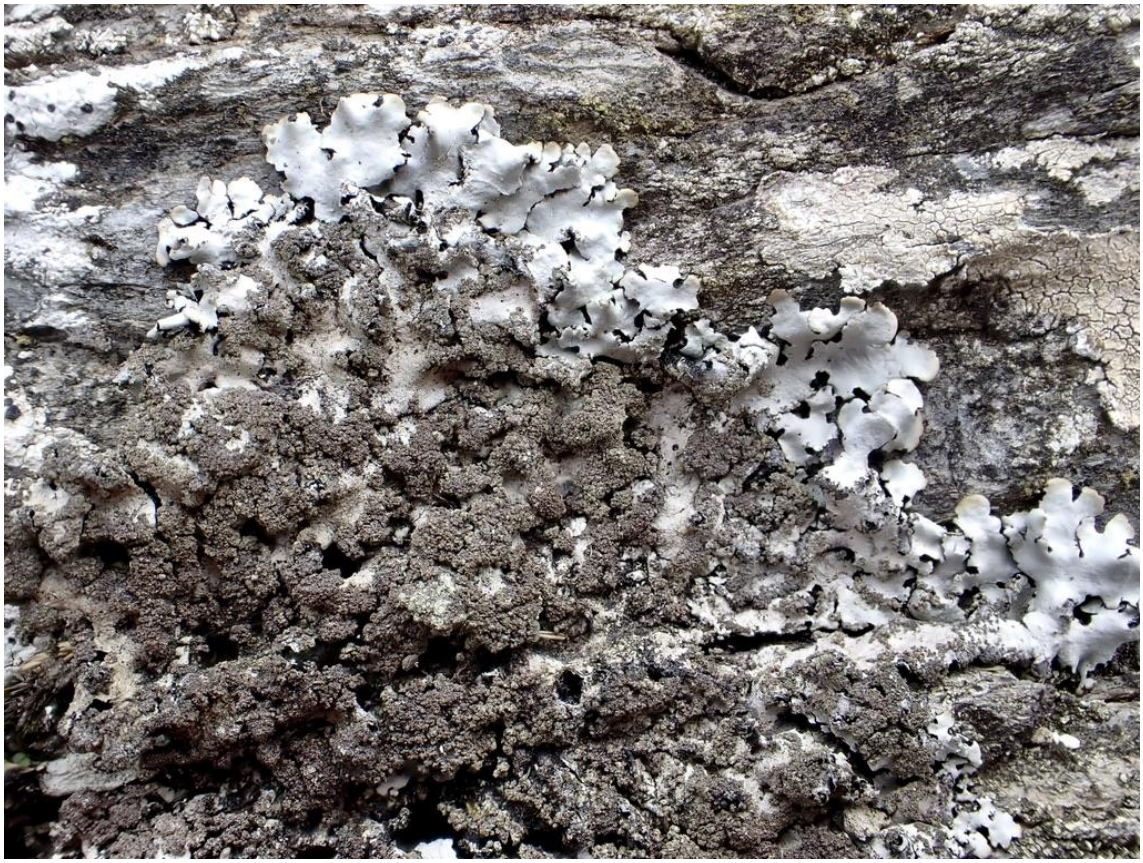


Figure 28. *Hypotrachyna britannica* on rock in the coastal heath, Location B.

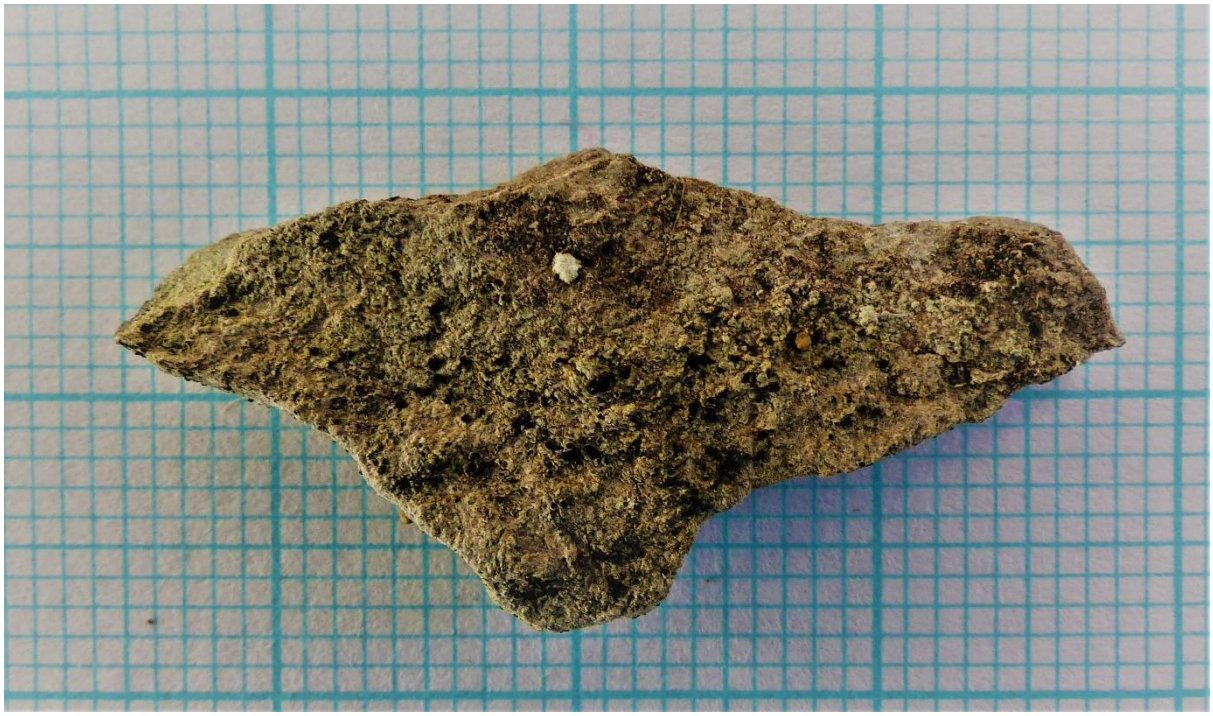


Figure 29. *Buellia abstracta* (small black apothecia) on stonelet (on cm graph paper background), Pen yr Hwbyn, c. 1 km W of Mwnt, SN181517, coll. S.P. Chambers, 6 October 2021. (Specimen in hb. SPC). Photo: S.P. Chambers.

Location C

A narrow ledge, c. 1-1.5 m wide, of hard, well-lit rock running along the edge of the high sea-cliff on the cliff top above the first cove feature c. 75 m SW of Pen yr Hwbyn, centred on GR22(SN)181517. The location holds a good concentration of photophilic, hard rock specialist maritime lichens.

Species recorded include ***Anaptychia runcinata*** (very abundant and frequently fertile), ***Blastenia* (*Caloplaca*) *crenularia*** (frequent), ***Cladonia rangiformis*** (associated dry grassland edge), ***Diploschistes caesioplumbeus*** (rare, c. six thalli seen in one place on rock directly above the vertical cliff), ***Lecidella scabra*** (abundant and fertile), ***Parmelia saxatilis*** (rare), ***Pertusaria pseudocorallina***, ***Ramalina siliquosa*** (frequent), ***Rhizocarpon geographicum*** (very rare), ***R.richardii*** and ***Xanthoparmelia delisei*** (c. 7 patches in one area over c. 1 x 0.5 m).

Figure 30. *Diploschistes caesioplumbeus*.


Figure 31. *Xanothparmelia delisei* above with *Diploschistes caesioplumbeus* below.

Location D

The lower mesic supralittoral to eulittoral zones around low mean tide level on the end of the Pen yr Hwbyn promontory over the extensive rocky lower shore where the stream enters the sea, centred on GR22(SN)1824.5174. The lichens were not listed exhaustively and the list below is not a full inventory.

Species Noted-

***Caloplaca* "aff. *sorediella*"**: on dead base of *Armeria maritima* on rock slope in the mesic supra-littoral zone (see Taxonomic Notes)
Collemopsidium foveolatum: abundant on barnacles in the littoral zone. Individual mature barnacles carried high numbers and densities of immersed perithecia of the lichen. A sample of barnacles (n = 12) had a mean of c. 58 intact individual perithecia and an estimated c. 3-4 times as many more empty pits, giving an approximate total of 232 – 290 perithecia (functional and effete) per barnacle.
Collemopsidium halodytes: occasional on damp rock throughout the littoral zone
Flavoplaca* (*Caloplaca*) *marina: occasional in the mesic-supralittoral zone
Flavoplaca* (*Caloplaca*) *microthallina: rare on *Hydropunctaria maura* in the littoral zone
Halecania ralfsii: seen in two places on shelving sloping rock in the upper littoral zone
Hydropunctaria* (*Verrucaria*) *maura: abundant in the littoral zone
Lecania atrynoides: rare on sloping, well-lit, rock in mesic-supralittoral zone, growing with *Lecanora poliophaea*. First record for VC46 Ceredigion hb. DML.
Lecanora actophila: occasional on well-lit rock in the mesic-supralittoral zone
Lecanora poliophaea: rare on sloping, well-lit, rock in mesic-supralittoral zone, growing with *Lecania atrynoides*.
Lecanora zosterae: on dead *Armeria maritima* bases in the mesic-supralittoral zone
Lichina confinis: frequent in the littoral zone

Lichina pygmaea: occasional large widespreading patches, the biggest to c. 20 x 10 cm, in the littoral zone, especially at GR (GPS) 22(SN)18244.51748. Commonly fertile. Herb. SPC.
Ramalina cuspidata: occasional small tufts noted on sloping rock faces inclined to the W in the mesic-supralittoral zone
Ramalina siliquosa; occasional in the mesic-supralittoral zone
Rinodina oleae: frequent in the mesic-supralittoral zone (*R.gennarii*-ecotype)
Stigmidium marinum: noted twice on *Wahlenbergiella* (*Verrucaria*) *mucosa*, but probably frequent
Toniniopsis aromatica: occasional along rock crevices in the mesic-supralittoral zone
Variospora* (*Caloplaca*) *thallincola: occasional in the mesic-supralittoral zone
Verrucaria ditmarsica: seemingly rare on sheltered rock in the littoral zone
Verrucaria prominula: common to locally abundant and often codominant with *Hydropunctaria maura* on damp rock in both zones; very fine material making the best locality for the species to date in the VC
Wahlenbergiella* (*Verrucaria*) *mucosa: frequent in the low-littoral zone
Wahlenbergiella* (*Verrucaria*) *striatula: abundant on damp rock around low tide level and above in the eulittoral. Herb. SPC. Most thalli were very heavily ridged. A selection of the most markedly so were sampled looking for the rare *Collemopsidium elegans*, but that species was not detected.
Xanthoria aureola: occasional in the mesic-supralittoral zone

Figure 32. Sloping hard rock on the shoreline in Location D looking eastwards towards Mwnt.

Figure 33. *Caloplaca* (*Variospora*) *thallincola* and *Hydropunctaria maura*, Location D.

Figure 34. *Lichina pygmaea*, Location D. Note: camera flash has ‘bleached’ the appearance of the lichen which appears dark blackish in the field.

Figure 35. *Verrucaria* (*Wahlenbergiella*) *mucosa* and *Collemopsidium foveolatum* on barnacles, Location D.

Figure 36. *Verrucaria* (*Wahlenbergiella striatula*), Location D.

Location E

Extensive, exposed shelving rock platform, sloping north-eastwards down from below the coastal path to the rocky shore W of Pen yr Hwbyn, centred on GR (GPS) 22(SN)18107.51720. The area appeared to have potential, but insufficient time meant it was looked at only briefly and the littoral zone on the rock shore at the bottom was not inspected.

Noteworthy Species Recorded (not an inventory) -

Athallia* (*Caloplaca*) *holocarpa s. str.: on bird-perch part of rock exposure
Bacidia scopulicola: rare, but seen fertile on sheltered rockface
Diploschistes caesioplumbeus: occasional on well-lit hard rock faces
***Lecanora dispersa* agg.**: occasional on rock faces. Coastal examples of this 'dust bin collective' probably represent several potentially undescribed species
Lecidella asema: occasional small fertile thalli on one part of the rock shelf
Lecidella meiococca: occasional small patches on rock face
***Muellerella* sp.**: on the thallus of *Porpidia platycarpoides* (see note below)
Porpidia platycarpoides: abundant on rock faces
Rhizocarpon richardii: occasional
Solenopsora vulturiensis: very frequent along moist crevices and narrow ledges, and seen fertile once
Xanthoparmelia delisei: locally very abundant on the upper-middle part of the rock shelf

Stretch of coast extending for c. 300m eastwards from opposite Cardigan Island (Hastiholm/Hasti Holm) and Carreg Lydan to the N of Clyn-yr-ynys (Locations A – F)

Date of Visit: Thursday 7 October 2021

Surveyors: SPC & DML

Figure 37. Cardigan Island from Carreg Lydan.

Figure 38. View along the eastern edge of the Carreg Lydan headland towards Cardigan Island with the sloping rock platforms of Location D in the mid distance and ‘Mwnt bach’ n the centre foreground.

Figure 39. View over 'Mwnt bach' eastwards to Mwnt.

Location A [F in main body of report]

Softwood posts and rails in the long lengths of fence-line running around the edge of the sea cliff. The fence posts and rails were examined, as they can often provide an interesting habitat for lignicoles of maritime affinity in coastal situations.

Catillaria flexuosa was recorded new to Great Britain here (see 3.2.2 and Appendix 3).

General lignicoles included *Amandinea punctata, Athallia* (*Caloplaca*) *holocarpa s.str., Candelariella vitellina, Cliostomum griffithii* (pycnidiate morphs on dry, rain-sheltered sides), *Fuscidea lightfootii, Lecanora confusa, L.dispersa* agg., *L.pulicaris, L.saligna, L.symmicta, Lecidella elaeochroma* f. *elaeochroma, Lecidella elaeochroma* f. *soralifera* (the 1st VC46 lignicolous record of the *forma*), *L.scabra, Myriospora smaragdula* (on inclined strainer post), *Physcia aipolia, P.tenella, Ramalina siliquosa* (large colonies of stunted thalli down the drier, exposed N-NW-sides of a few posts), *Rinodina oleae* (*R.gennarii*-ecotype; very common on nutrient-enriched tops) and *Xanthoria parietina.*

Of note, a single small, c. 1.5 cm diam., thallus of the ornithocoprophillous *Polycauliona (Caloplaca) verruculifera* was seen on the flat cut top of one fencepost. This species occurs almost exclusively on coastal rocks manured by seabird guano and only very rarely on timber on coastal fence-posts (Fletcher & Laundon, in Smith *et al.* 2009). This is the first such lignicolous Cardiganshire record. It is a phenomenally abundant and dominant lichen on the gull infested Cardigan Island a few hundred metres offshore to the NW. Close-source, heavy propagule pressure has enabled it to colonize, likely vectored by gulls, from the island. Also of note, a few thalli of lignicolous *Acarospora impressula* and *Lecanora fugiens* were seen on the dry sides of strainer posts in the fenceline, the largest thalli of *L.fugiens* attaining c. 3 x 1 cm. Neither of these lichens appear to have been reported growing on lignum before in Britain.

Even more remarkable with regard to instances of strict saxicoles moving onto lignum substrata in maritime environments, for which no precedents appear to exist for such substrate-switching ecological behaviour, the dry N-sides of a fence rail and strainer post above the rocky shore at GR 22(SN)16318.51330, had a most remarkable range of crustose saxicoles, including *Arthonia* (*Opegrapha*) *calcarea, Blastenia* (*Caloplaca*) *crenularia* (thalli to c. 7 x 4cm), *Catillaria* sp. (apothecia infected by *Intralichen lichenum*, new for VC46, hb. v.d. Boom – see Taxonomic Notes) and *Tephromela atra.*

In a similar vein, three weak and barely fertile, suntanned-brown lignicolous thalli of the primarily epiphytic *Rinodina sophodes* were seen growing with endoxylic morphs of *Amandinea punctata* on the S-side of a nutrient-rich softwood fencepost in a fenceline between field parcels at SN164512, alt 30m. There is one other lignicolous VC46 record of *R.sophodes* (from the wooden handrail of a footbridge on the coastal path at Cwm Soden in 2015). *R.sophodes* is a common enough twig epiphyte, however it does not appear to have been reported on lignum elsewhere in Europe.

Figure 40. Example of the fence around Carreg Lydan (Location A).

Figure 41. *Caloplaca* (*Polycauliona*) *verruculifera* on the top of a strainer post, a rare occurrence of this taxon on worked timber.

Figure 42. *Myriolecis* (*Lecanora*) *fugiens* (centre) on fence rail with *Leanora saligna*, *Ramalina siliquosa*, *Xanthoria parietina* and *Lecidella elaeochroma*. Possibly the first record of this taxon from lignum in the British Isles.

Location B [G in main body of report]

A large, low, circular concrete pad, c. 2.5 m (estimated by eye) in diameter, a few inches above ground-level, located in grassland near the cliff top fence directly opposite the island held a range of poorly developed common calcicoles, with *Aspicilia calcarea, 'Caloplaca' arcis* (very poorly developed, but one fertile patch was seen), *'C'.flavocitrina, 'C'.flavovirescens, 'C'.oasis, Candelariella aurella, C.vitellina, Lecanora albescens* agg. and *Verrucaria macrostoma* f. *macrostoma.*

Figure 43. *Aspicilia calcarea*, Location B.

Location C [H in main body of report]

A small ground-level rock outcrop ringed by thin maritime turf, in pasture close to the cliff-top fenceline opposite Carreg Lydan, at GR22(SN)16266.51349, alt 20m. The ground on and around the outcrop was noticeably trampled, perhaps by people utilizing the spot as a scenic viewpoint.

Species recorded included *Agonimia gelatinosa s. str.* (on a compressed, damp, biofilm-like crust of sandy soil on the edge of the rocky area, confirmed microscopically; the rare or overlooked *A.globulifera* is known in VC46 on the coast nearby at Craig y Gwbert and also on the coast between Trwyn Crou and Ynys-lochtyn, but *A.gelatinosa s. str.* is otherwise known on the coast only on Foel-y-Mwnt), *Amandinea pelidna, Anaptychia runcinata, Arthonia varians* (on *Lecanora rupicola*), *Candelariella vitellina, Lecanora fugiens, L.gangaleoides, L.rupicola, Lecidella scabra, Porpidia platycarpoides, Ramalina siliquosa, Rhizocarpon reductum, Scoliciosporum umbrinum, Scytinium* (*Leptogium*) *tenuissimum* (a small lobelet on sandy soil) and *Verrucaria fusconigrescens.*


Figure 44. S. P. Chambers at Location C, Cardigan Island in the background

Location D [I in main body of report]

Extensive sloping rocky shore platform and sea-edge cliff beyond, to the N of the cliff-top fenceline, centred on GR22(SN)1632.5134.

The upper rocky platform and steeply angled upright rock exposures of the lower shore supported a good range of maritime lichens. Species recorded included *Anaptychia runcinata, Aspicilia leprosescens* (fertile)*, Bacidia scopulicola* (rare), *Blastenia* (*Caloplaca*) *crenularia, Caloplaca ceracea, C.littorea* (very rare, c. three small thalli under overhang; the 3rd VC record, previously recorded only from Cardigan Island and the 1st record from the mainland), *Candelariella aurella* (base-enriched side of rockface – this calcicole is known on sea water-sprayed siliceous rock at other coastal sites in the VC), *C.vitellina, Catillaria chalybeia, Cliostomum tenerum* (rare under overhang), *Collemopsidium foveolatum, C.halodytes, Diplotomma chlorophaeum, Flavoplaca* (*Caloplaca*) *marina, F.* (*Caloplaca*) *microthallina, Haloplaca* (*Caloplaca*) *britannica* (rare, under overhangs on the dry sloping sides of upright rock faces, and directly on thalli of *Hydropunctaria maura* in such niches; the 4th VC46 record. *H.britannica* has been observed inhabiting *H.maura* at other sites on the coast in the VC), *Halecania ralfsii* (several small thalli on one sloping rockface), *Hydropunctaria* (*Verrucaria*) *maura, Lecania aipospila* (two thalli on nutrient-enriched rock), *L.suavis* (rare below overhangs), *Lecanora dispersa* agg., *L.helicopis, Lecidella asema* (locally frequent on shelving rock ribs; possibly the largest and best-developed VC-population), *L.scabra, Ochrolechia parella* (inc. one thallus hosting two apothecia of *Sclerococcum* (*Dactylospora*) *parellarium*; 2nd VC record [1st was SN46F])*, Opegrapha cesareensis, Physcia tenella* ssp. *marina, Polycauliona* (*Caloplaca*) *verruculifera* (rare on nutrient-enriched sloping rockface below bird-perch), *Ramalina cuspidata* (fertile)*, R.siliquosa, Rhizocarpon geographicum* (rare), *R.richardii, Rinodina oleae* (*R.gennarii*-ecotype), *Solenopsora vulturiensis, Tephromela atra, Toniniopsis aromatica, Variospora* (*Caloplaca*) *thallincola, Verrucaria prominula, Wahlenbergiella* (*Verrucaria*) *mucosa, W.striatula, Xanthoria aureola* and *X.parietina.*

To the E, a high sea stack (‘Mwnt-bach’) shortly offshore in a large cove looked most promising, but was completely inaccessible. On the edge of the sea cliff overlooking the stack, *Anaptychia runcinata* was seen growing on dead *Armeria maritima* and *Lepraria nivalis* on dry soil.

A dead *Ulex europaeus* stem on a bush in a semi-open patch of mixed *Dactylis glomerata - Pteridium aquilinum - U.europaeus* 'grass-scrub' on the lower edge of the coastal pasture above, SN164513, alt 30m, had *Athallia* (*Caloplaca*) 'aff. *cerinelloides*' (see Taxonomic Notes), *Arthonia* (*Opegrapha*) *atra, Bacidia laurocerasi, Bryostigma lapidicola* (syn. *Arthonia muscigena*), *Lecania naegelii, Lecanora persimilis* and *Physcia adscendens.*

Figure 45. *Aspicilia leprosescens* (fertile).

Figure 46. Caloplaca britannica (yellow thalli) and Lecania suavis (to the right).

Figure 47. *Bacidia scopulicola* in dry underhang, Location E.

Figure 48. A closer view of *Bacidia scopulicola* in a dry underhang, Location E

Location E [J in main body of report]

Vertical rock faces at the S-end of an inlet, SN164513, some distance away and up from the shore and consequently with a reduced maritime influence. The faces appeared to be the only readily accessible saxicolous habitat associated with the inlet. A few dry rock underhangs were present, but apart from *Opegrapha cesareensis* no significant species were found. Lichen communities were very poorly developed, the majority of crusts being in moribund, often unrecognisable condition, perhaps as a result of invertebrate grazing.

Species recorded included *Acarospora privigna* (syn. *Polysporina simplex*), *Arthonia* (*Opegrapha*) *calcarea, Bacidia scopulicola* (fertile and locally frequent in sheltered places), *Catillaria chalybeia, Diplotomma chlorophaeum, Flavoplaca* (*Caloplaca*) *flavocitrina, Gyrographa* (*Opegrapha*) *gyrocarpa, Hydropunctaria* (*Verrucaria*) *maura, Lecania suavis, Lecidella scabra, Ochrolechia parella, Opegrapha cesareensis, Pertusaria pseudocorallina, Porpidia platycarpoides, P.tuberculosa, Ramalina siliquosa, Rhizocarpon reductum, Solenopsora vulturiensis* and *Verrucaria fusconigrescens.* Dead basal parts on a clump of *Armeria maritima* had *Anisomeridium polypori.*

Location F [K in main body of report]

SSE-facing sloping ground-level rock outcrops with associated peripheral, dry maritime grassland*, set in coastal pasture at GR22(SN)16305.51314, alt 14m.

Species recorded included *Amandinea pelidna, Cladonia rangiformis*, Lecanora gangaleoides, Peltigera canina*, P.hymenina** and *Pertusaria pseudocorallina.*

Of special note, a number of thalli of *P.pseudocorallina* hosted the rare *Sphinctrina tubiformis,* the 1st VC record (hb. SPC).

Many thalli of *P.pseudocorallina* appeared modified by Acarid mites (‘mite mutilated’) residing within open-topped, domatia-like swollen surface structures looking to have developed from the shed bases of old isidia and distorted isidial regrowth. In the field some of the structures looked remarkably ascomata-like. The interior of one was later examined microscopically and found to contain pale brown pycnidial gel and simple bacilliform rod-like straight colourless conidia, c. 8 – 11 x 1 µm. Pycnidia and conidia do not appear to have been reported before in *P.pseudocorallina* in Britain. Though speculative the combination of mites and the formation of pycnidia if not coincidental could perhaps be causative.

Figure 49. Small black dots on rather tattered looking *Pertusaria pseudocorallina* are *Sphinctrina tubiformis*.

Figure 50. Mite damage on *Pertusaria pseudocorallina* associated with the formation of pycnidia, possibly the first report of pycnidia in British material.

Historic records

Cardigan Island (Hastiholm)

Cardigan Island has been surveyed for lichens on two occasions (Chambers 2009 & 2013, unpublished). Notable maritime lichens recorded on the two surveys from the island include *Amandinea pelidna, Aspicilia leprosescens* (fertile)*, Bacidia scopulicola, Caloplaca britannica, C.littorea, C.maritima, C. '*aff. *sorediella'*, *Diploschistes caesioplumbeus, Lecania aipospila, L.fructigena, L.subfuscula* (the only Welsh site to-date, though it is likely to occur on the Pembrokeshire islands)*, Lecanora poliophaea, L.zosterae, Llimonaea sorediata, Opegrapha cesareensis, Polycauliona verruculifera* and saxicolous *Ramalina lacera*.

Lichens on soft sea cliffs in Britain

The primary source of information is Gilbert (2003), who surveyed a representative range of different soft sea cliff sites around the English coast. No Welsh sites were included in the study, however, but many of the characterizing indicator species identified by Gilbert on English soft sea cliffs occur also on the Cardiganshire coast (Chambers, unpublished).

Appendix 3. Taxonomic Notes

***Athallia* (*Caloplaca*) 'aff. *cerinelloides*'**

On a dead *Ulex europaeus* stem on a bush c. 3ft up, in a semi-open patch of mixed *Dactylis glomerata - Pteridium aquilinum - U.europaeus* 'grass-scrub' on the lower edge of a coastal pasture, c. ½ km NNW of Clyn-yr-ynys, SN164513, alt 30m, coll. S.P. Chambers, 7 x 2021. Asci 8-spored, ascospores smaller and narrower in particular (9 – 11 x 4.7 – 5.4 µm) compared to *A.cerinelloides.* The material appears to match the recently (2012) described *Caloplaca skii*, a widespread species of xerophilous shrubs in S & SE Europe, but not as yet reported from Britain.

***Caloplaca* 'aff. *sorediella*'**

An undescribed species with a Mediterranean distribution previously lumped with the sorediate entity currently recorded under the name *C.sorediella* by British lichenologists (pers. comm. to SPC from Ulf Arup). The species appears occasional on Welsh coasts northwards to Pen-llyn (VC49), and possibly Ynys Mon (VC 52). Probably in the *Haloplaca* clade, the Welsh material awaits molecular study.

Catillaria flexuosa

On north-facing side of a weathered softwood fencepost on sea-cliff above rocky shore opposite Cardigan Island, c. 500 m N of Clyn-yr-ynys, Gwbert, VC46, Cardiganshire, GR SN163.513, alt 20 m, October 2021. Hb. SPC (specimen in herb. v.d. Boom). Like the common *C. chalybeia*, but deviating in having a markedly thicker, dark greenish-brown subsquamulose thallus with knobbly granules, relatively larger apothecia (to c. 0.9 mm diam.) with often flexuose proper margins, and slightly smaller ascospores, c. (6-)7-10(-11) x 2.5-3.5(-4) µm. Recently described from The Netherlands growing corticolously on roadside Fraxinus excelsior, but possibly overlooked for expressions of the very variable *C. chalybeia* and perhaps also *C. nigroclavata*. For full description and further details see P.P.G. v.d. Boom & P. Alvarado in Lichenologist 53: 193-202.

***Muellerella* sp.**

Inducing conspicuous pale white-grey raised galls on thalli of *Porpidia platycarpoides* growing saxicolously in the upper mesic-supralittoral zone in a fully open position on a rock platform sloping gently east-northeastwards, c. 50 m west of Pen yr Hwbyn, c.1¼ km west of Mwnt, GR22(SN)18107.51720, alt 20 m, Coll. S.P. Chambers, 6 x 2021. Specimen in hb. SPC. The galls were distinctly paler in colour than the thallus of the host. Microscopically resembling the widespread *M.lichenicola*, but that species chiefly inhabits hosts on calciferous substrates. Furthermore, its perithecia are immersed and scattered, and are not known to develop within or induce the formation of galls. In addition, the ascospores in the collection are consistently slightly wider (at c. 3.4 – 3.7 µm) than the ascospores of *M.lichenicola*, which has a slightly narrower mean ascospore width of (2-)2.5-3(-4) µm. The galls resemble those produced by *Cecidonia xenophana* also occurring on *Porpidia* hosts, but contain immersed perithecia and not subsessile apothecia.

Sterile sorediate crust

Growing on a ± N-facing, damp acid Silurian shale face on the cliff top W of Upper Borth, GR22(SN)601887, alt 40m, Coll. S.P. Chambers & D.M. Lamacraft, 25 ix 2021. An unidentified sterile sorediate crust, somewhat resembling a depauperate saxicolous morph of *Mycoblastus caesius*, having a light grey, thin thallus with a very slight blue-grey tinge and discrete, soft pale greenish soralia (soredia c. 20 – 30 µm diam.), Pd-, K+ strong yellow (on white filter paper), KC-, C-, UV+ white. Specimen in hb. SPC.

Appendix 4. Current names and recent synonyms

Current name	Recent synonym
Acarospora privigna	*Polysporina simplex*
Alyxoria ochrocheila	*Opegrapha ochrocheila*
Arthonia atra	*Opegrapha atra*
Arthonia calcarea	*Opegrapha calcarea*
Caloplaca stillicidiorum	*Caloplaca cerina var. chloroleuca*
Enchylium tenax	*Collema tenax var. tenax*
Enterographa zonata	*Opegrapha zonata*
Gyrographa gyrocarpa	*Opegrapha gyrocarpa*
Myriolecis actophila	*Lecanora actophila*
Myriolecis albescens	*Lecanora albescens*
Myriolecis dispersa	*Lecanora dispersa*
Myriolecis fugiens	*Lecanora fugiens*
Myriolecis persimilis	*Lecanora persimilis*
Myriolecis zosterae	*Lecnaora zosterae*
Scytinium biatorinum	*Leptogium biatorinum*
Scytinium palmatum	*Leptogium palmatum*
Scytinium tenuissimum	*Leptogium tenuissimum*
Sytinium teretiusculum	*Leptogium teretiusculum*
Toniniopsis aromatica	*Toninia aromatica*

Data Archive Appendix

Data outputs associated with this project are archived on server–based storage at Natural Resources Wales.

The data archive contains:

[A] The final report in Microsoft Word and Adobe PDF formats.

[B] A spreadsheet of lichen records.

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue https://libcat.naturalresources.wales (English Version) and https://catllyfr.cyfoethnaturiol.cymru (Welsh Version) by searching 'Dataset Titles'.

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