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MARITIME AND MARINE LICHENS OF
HOWTH HEAD, IRELAND

Knowles, Matilda C. "The maritime and marine lichens of Howth." *Sci. Proc. Roy. Dublin Soc.*, **14**, 1913, pp. 79—143, 7 plates, 1 map.

The area investigated, Howth Head, forming the northern boundary of Dublin Bay, is a peninsula of high rocky land about 4 square miles in extent and with a coast-line of about 8 miles, the highest point being about 180 m. above sea-level, and is separated from the mainland by a low isthmus (about 3 m. above ordinary high-water mark) hardly half a mile wide. The rocks are entirely Palaeozoic, mainly Cambrian grits, shales and quartzites, while beds of Carboniferous limestone lie along the western side of the promontory and are exposed on the shore. During autumn and winter fogs are frequent, enveloping the headland in mist, and the cliff-faces are then often dripping wet from surface drainage, but in summer this supply is largely cut off and the vegetation is sometimes subjected to long spells of drought. The only streams are small brooks, but there are several springs and in places the shore rocks are kept constantly damp by fresh water oozing from the base of the cliffs; at these places, and wherever fresh water flows, a different set of lichens and algae is found.

The authoress notes that the lichens of the sea-shore have hitherto been but little investigated. Weddell (1875) divided the lichens of rocky shores of the Ile d'Yeu (Vendée, France) into (1) marine, growing on rocks covered at every tide, e.g. *Lichina pygmaea*; (2) semi-marine, not requiring complete immersion but benefiting by the splashing they receive from waves breaking at the base of the rocks of which they occupy the sides, e.g. *Verrucaria maura*, *Lichina confinis*; (3) maritime, growing beyond reach of the waves but coming under the influence of the salt breeze. Sandstede in several papers on the lichens of the German North Sea islands gives ecological notes, with lists of species growing on rocks splashed by sea-water and those preferring higher levels. Warming (*Ecology of Plants*, 1909) describes three belts of lichens as characteristic of the coasts of Denmark and Sweden—"lying lowest on the shore, where the rocks are very frequently wet, is *Verrucaria maura*, a very thin black scaly lichen divided into small pieces; higher up the rocks are reddish yellow with *Placodium murale*, which is accompanied by *Physcia parietina*; above this follows a belt of *Ramalina scopulorum*—here the action of the salt water is reduced to almost nothing." Practically all that has been written on the ecology of coast lichens refers to the marine group and is found in the works of Børgesen, Jónsson, Joubin, and Cotton; by far the most complete account is that contained in Cotton's memoir on the marine algae of Clare Island (see this JOURNAL, **1**, 1913, pp. 209—215).

Lichens grow on many different kinds of substrata, but there are three on which they occur more abundantly than any others—rocks, bark of trees and wood, and the soil; from this point of view lichenologists have arranged them in the three groups of saxicolous, corticolous, and terricolous¹. These may perhaps represent three formations, but pending further investigations it seems better to abstain from employing the terms formation and association. All three groups occur on the Howth shores, the saxicolous being the most abundant; the corticolous forms occur only in one place in blackthorn (*Prunus spinosa*) thickets, and the terricolous forms were studied mainly on earth cliffs in two localities.

The greater part of the paper is devoted to the saxicolous lichens, especially those on silicious rocks. Three main bands are seen on the Howth coast—a lower dark band composed of species of *Verrucaria* and *Lichina*, an intermediate orange band of *Placodium*, *Physcia*, etc., and an upper grey-green band of *Ramalina*. The belts are described in the following order:—(1) *Ramalina* belt, (2) orange belt, (3) *Lichina* vegetation, (4) *Verrucaria maura* belt, (5) belt of marine Verrucarias.

(1) The *Ramalina* belt is very wide, extending from just above spring-tide high-water mark to the tops of the highest cliffs and even inland, and is well developed both in sheltered and exposed situations; the most extensive colonies and the strongest growths are always found on

¹ See article by O. V. Darbishire in this JOURNAL, **2**, 1914, pp. 71—82.

the windy sides of the quartzite cliffs of the south and southwest coasts, while on the drier and more sheltered eastern and northern coasts the *Ramalina* growths though widespread are usually sparser and the tufts more stunted and less healthy-looking. The Ramalinas grow in two well-marked zones; those of the lower zone are usually very fertile, the plants consisting of straight stiff simple or slightly branched fronds of a pale grey-green or straw colour; while the Ramalinas of the upper zone are usually barren, have much-branched fronds of a darker colour and somewhat glaucous appearance, with the extreme tips incurved. Those in the lower zone are grouped together as *Ramalina scopulorum*, while those in the upper zone are apparently forms of this species together with occasional plants of *R. Curnowii* and *R. subfarinacea*.

The *Ramalina* of the lower zone, *R. scopulorum*, is always found within reach of the spray, and covers with a tufted growth the tops and sea-faces of the large rocks which lie on the shore a little above high spring-tide level; in the lower part of the zone it occurs in irregular tufts here and there, sometimes associated with *Lichina confinis*, *Placodium* and *Verrucaria maura*; upwards it overlaps and gradually disappears among the upper Ramalinas. The lower Ramalinas grow in tufts from a cushion-like base which may be more than 6 mm. thick at the centre and from the lower surface of which numerous slender branching hyphae penetrate in rhizoid-like strands between the irregularities of the rock and wind themselves round the small projections, sometimes enclosing particles of the rock in their meshes; as the tissues of the fronds are continuous with those of the basal area, they are thus securely anchored to the substratum.

The Ramalinas of the upper zone are much more abundant and variable than those of the *R. scopulorum* zone. Three well-marked forms occur, which in places pass almost imperceptibly into each other. The prevailing form, provisionally termed *Ramalina A*, grows above the ordinary spray zone and usually forms a sward-like growth on the weather sides of the lower cliffs, the plants growing both larger and closer together along the upper edges where the rock and earthy covering meet, or in the neighbourhood of *Armeria maritima* or other flowering plants that occupy crevices in the cliff faces (Pl. XIX, Fig. 2). The thallus of *Ramalina A* has a glaucous appearance and is much branched; many of the branches are dilated and fistular and have the upper surface covered with tuberculations. At higher levels the sward-like growths of *Ramalina A* disappear and are replaced by isolated tufts scattered irregularly on the rock surface, the thallus also becoming smaller and more amorphous and the pustulations and disorganised areas more numerous, *Ramalina A* gradually passing into a very small amorphous form called *Ramalina B* which seems to be peculiar to the vertical or almost vertical western and southwestern faces of the highest cliffs. On these steep rock-walls (Plate XX), whose smooth surface is broken only here and there by an occasional ledge or crevice on which a few plants of *Erica* and *Calluna* have established themselves, *Ramalina B* is the only lichen growth; it is everywhere closely adpressed to the rock surface, and the individual tufts are very small (rarely over 12 mm. high) and amorphous with the fronds much lacerated. As compared with *Ramalina A* which grows in places with a fairly constant supply of moisture from surface drainage or drippings from the leaves of the flowering plants during rainy weather, *Ramalina B* grows under very severe conditions on the steep rock-faces: the hard and close-grained quartzite retains little moisture and affords scanty foothold, the plants are exposed to the full force of the prevalent winds, being well above the spray they receive moisture only from that carried by the winds in rainy weather or absorbed from the air during mists, and in spring and summer there are often long spells of dry sunny weather during which *Ramalina B* becomes burnt up and brittle. It is remarkable that while crustaceous lichens are usually regarded as being the first colonisers, these steep rock-faces show a complete absence of crustaceous species; the problem as to how *Ramalina B* has gained a foothold on these very hard precipitous rocks, too inhospitable even for crustaceous species, is an interesting and puzzling one. The third form, *Ramalina C*, is found in shade and shelter, chiefly on the eastern sides of the cliffs; the thallus is relatively soft in texture, much compressed, repeatedly branched in a dichotomous manner and with the tips of the branches elegantly incurved.

From top to bottom of the *Ramalina* belt, where the growth is not so dense as to exclude too much light and air, numerous foliaceous and crustaceous lichens often find shelter among the tufts of the *Ramalina* fronds. Some push their way towards the shore; others, whose natural habitat seems to be the rocks about high-water level, extend their range upwards. This sub-vegetation occurs in more or less distinct zones descending in order towards the sea: Parmelias, *Physcia aquila*, *P. parietina*, crustaceous species. The Parmelias, which extend up to the very

summit of the headland, are usually found on the most weathered rocks, in situations where they are sure of a fair supply of moisture and where there is shelter from severe winds. Along the upper edge of the cliffs they are often associated with the mosses *Grimmia maritima* and *Weisia rupestris*; here the Parmelias seem to have reached their ordinary seaward limit, but the shelter and protection afforded by the *Ramalina* growths enable them to penetrate to lower levels, and in moist shady places they may even reach the shore, often accompanied by the two mosses. Of the Parmelias, *P. conspersa*, *P. Mougeotii*, *P. proluxa* and *P. fuliginosa* occur commonly all round the headland but are much more abundant along the southwestern coast, while *P. perlata*, *P. saxatilis*, *P. omphalodes* and *P. physodes*, being more alpine in character, keep to higher levels on the sunny southwestern coast but are the usual forms on the eastern and northern coasts where they are sometimes seen growing on rocks almost at sea-level; *P. proluxa*, the most general of all the species and the one which penetrates furthest towards the sea, does not often grow associated with any other species but forms large stretches of pure brownish-green growths on the sloping surfaces of the rocks, mainly on those with an easterly incline and in sheltered and rather shady situations, covering bare spaces between the *Ramalinas* and often competing with them for room. Of the Physcias, *P. aquila* prefers shady sheltered positions and especially a northeast aspect, and often pushes its way down the shore, swamping the *Ramalinas*: its brown thallus forms small circular patches round the attachment areas of the *Ramalinas* and as the patches increase in size they overgrow the *Ramalinas* and exterminate them, the *Physcia* thallus being so closely attached to the *Ramalina* fronds that it seems to be epiphytic on them.

Since the connexion between the thallus of the crustaceous lichens and the rocks on which they grow is so much more intimate than is the case with foliaceous species, they are able to thrive under much more adverse conditions and to colonise steeper surfaces, hence the crustaceous subvegetation is most often found on the steeper rocks where the conditions of shelter and moisture are insufficient to support the foliose forms, and it is almost the only subvegetation met with in the lower reaches of the *Ramalina* growths. Some of the species (*Buellia* spp., *Lecanora* spp., *Opegrapha calcarea*) occur throughout the *Ramalina* belt but are most abundant in the lower part among the *R. scopulorum* growths. Plate XXI shows some colonies of *Lecanora atra* and *Buellia ryssolea* in the *R. scopulorum* zone. Other species are confined to the upper part of the *Ramalina* belt (*Lecanora glaucoma*, *L. polytropa*, *Rhizocarpon geographicum*, *Lecidea rivulosa*, *L. contigua*, *Pertusaria concreta* f. *Westringii*); these are mostly alpine forms. Other crustaceous forms are more or less confined to the lower part of the *Ramalina* belt, including various species which on sheltered shores grow below the *Ramalinas* but in exposed areas are often found among them (*Placodium murorum*, *P. lobulatum*, *Rhizocarpon alboatrum*, *Lecanora prosechoides*).

(2) The orange belt. Below the *Ramalinas* and between them and the sea several deep-yellow or orange coloured lichens form a belt of varying width all round the coast; in summer the colour of these lichens is so brilliant that the belt is easily recognised from a considerable distance, but in winter or during long spells of wet weather it becomes greenish-yellow and less conspicuous. The most abundant species and those which give the characteristic orange colour to the belt are *Physcia parietina*, *Placodium murorum*, *P. tegulare*, *P. decipiens*, *P. lobulatum*; in addition there are others less noticeable on account of their grey or nondescript colour but also forming important elements of the belt, the chief of these being *Lecanora prosechoides*, *L. umbrina*, *L. Hageni*, *Rhizocarpon alboatrum*, *Biatorina lenticularis*, *Rinodina exigua* var. *demissa*, and *Opegrapha calcarea* f. *heteromorpha*. Of the species in the first list *Physcia parietina* is more yellowish in hue and usually forms a distinct colour-band above the *Placodiums*, *Placodium murorum* usually occurs in the middle of the belt, while *P. lobulatum* comes lowest on the shore, in places extending down into the *Pelvetia* belt; all three lichens are frequently submerged at high spring-tide. The species of the second list grow scattered among the orange lichens on the flat and sheltered shores, but on the cliffs and steep rocks in more exposed places they often form large pure colonies of the orange lichens; for instance, where the surface is steep and the seas rough, *Physcia parietina* and *Placodium murorum* disappear, leaving *P. lobulatum* as the sole representative of the orange lichens, while *Lecanora prosechoides* appears as a grey band varying in width from 1 to 2 m. according to slope and exposure, while *Rhizocarpon alboatrum* and other species, as already mentioned, ascend in such situations into the *Ramalina* belt.

(3) The *Lichina* vegetation. Though *Lichina confinis* belongs to the semi-marine lichens and *L. pygmaea* to the marine group, the authoress follows Cotton in considering them together.

Both species are widespread on the Howth coasts, *L. confinis* usually occurring along the inner fringe of high-tide mark between the orange lichens and *Verrucaria maura* and slightly overlapping both these belts, *L. pygmaea* at a lower level below *V. maura* and usually defining the lower limits of this lichen but in some places extending down as far as low neap-tide. The alga *Pelvetia* may be taken as forming the upper limit of *L. pygmaea* and the lowest level at which *L. confinis* grows on these shores, but the width of the *Lichina* bands varies considerably, and *L. confinis* may grow as high as 50 feet above sea-level at Howth, while on the west coast of Ireland it may reach 200 feet.

(4) The *Verrucaria maura* belt normally occupies the part of the shore between high neap- and high spring-tide marks. It lies chiefly above *Pelvetia*, but where this alga is absent *Lichina pygmaea* often determines the lower boundary. On flat shores *V. maura* seems to occur along the whole range of *Pelvetia*, but it is found only on the higher parts of the rocks where it is submerged later than *Pelvetia* by the incoming tide. The belt is nowhere a wide one on the Howth coast, and is always more restricted in area on steep shores in sheltered localities; on the steep cliffs it is often only about 2 feet wide, but on low gently sloping shores it may reach a width of 8 to 10 feet. While *V. maura* is the dominant lichen in this belt, other species (*V. memnonia*, *V. prominula*, *V. aquatilis*) contribute to its formation and are characteristic of certain situations. Other lichens, invaders from the belts above and below, are also found. Some of the most frequent from the lower belt are species of *Arthrogyrenia* (*A. halodytes*, *A. leptotera*, *A. halizoa*), but these are not able to endure the same amount of exposure to sunlight and air as *V. maura* and do not grow in the open at these levels but always occur in shade or in cracks and crevices where they find conditions most nearly analogous to those of their usual habitats. The invaders from the orange belt are usually associated with *V. maura* only along the upper limits, though on flat shores in sheltered positions *Placodium murorum* and *Lecanora prosechoides* are seen spotting the dark crusts of *V. maura* throughout its whole range. Normally *V. maura* forms extensive stretches of pure growth about the middle of its range, is best developed in rather exposed and sunny places, grows on both flat and sloping rocks and on both smooth and broken surfaces, and avoids the pure quartz bands. The whole *V. maura* belt is submerged only during the highest spring-tides, but even during these periods the upper part of the belt is covered only for a short time each day, and in calm weather in summer during neap-tides the main part of the belt is often left exposed for a long time. When *V. maura* grows under drier conditions than usual the thallus is much more finely areolated and scabrid (var. *aractina*)—this variety forms a narrow zone along the upper part of the belt on dry sunny shores but is not found on the cliffs; while towards the lower limits of its range, where it is more often wetted by the sea, *V. maura* gradually passes into *V. memnonia* (*V. maura* var. *memnonia*), characterised by having the thallus more gelatinous and almost devoid of areolations—on shady cliffs *V. memnonia* sometimes almost replaces *V. maura* and at various parts of the coast forms good colonies on the cliff-faces 3 to 4 feet above ordinary high-tide level. The reddish-brown spots of *Arthrogyrenia halodytes*, sometimes 2 cm. in diameter, are found variegating the dark thallus of the Verrucarias; on the sides of the deeper rock-pools *A. halodytes* may form a narrow band below *V. maura* and associated with the crustaceous red alga *Hildenbrandtia prototypus*, while the bottoms of the shallower hollows are often coated with a crust of these two species. Where surface drainage runs down the grooves and cracks on the cliff-faces, or where tracts of rock on the beach are kept constantly damp by fresh water oozing from the base of the cliffs—areas often easily recognised by the presence of *Enteromorpha intestinalis*—the continuity of the *V. maura* belt is broken and another dark encrusting vegetation appears which is composed mainly of *V. aquatilis*, seen as dark streaks on the wet cliff-faces and extending right to the top in many places. The *V. maura* belt forms a transition zone between the maritime and the truly marine lichens, and constitutes Weddell's semi-marine group; on the exposed coasts of the west of Ireland *V. maura* grows, together with *Lichina confinis*, along the cliff tops in places more than 200 feet above the sea.

(5) The belt of marine Verrucarias comprises all the marine encrusting lichens (those which are submerged by the incoming tide each day) and lies mainly inside neap range; but on low flat shores, where the tides rise and fall gently, straggling colonies are found as far down as low water of the lowest spring-tide level. The lichens of this belt form a more or less continuous covering on the rocks of the upper part of the beach, but the growth becomes meagre and spotty nearer low water. The dominant species are *V. microspora*, *V. striatula* and *V. mucosa*; and *Arthrogyrenia*

is also abundant in the upper part of this belt. Three other species of *Arthrogyrenia* (*A. halizoa*, *A. leptotera*, *A. marina*) are sometimes present, but are nowhere abundant; *A. foveolata* and *A. litoralis* are common on barnacles, but the two latter species do not seem to grow on silicious rocks. The composition of the belt varies chiefly with the nature of the rock surface: on smooth rocks *V. mucosa* is the prevailing species, while *V. microspora* is more abundant on the rough quartzites and grits. Both species are very common round the coast and have a wide vertical range, extending from the *Pelvetia* zone down to the lowest ebb-tide mark, but the main part of their growth lies in the *Fucus spiralis* belt; *V. microspora* is better able to accommodate itself to a variety of conditions than *V. mucosa*, as it grows on both rough and smooth surfaces and on hard and soft rocks, it is more often found at *Pelvetia* level and is also the more usual of the two species on the rocks inside of the *Laminaria* belt.

Algologists have usually grouped *V. maura* and the marine lichens with *Hildenbrandtia*, and have treated them as one association. The authoress finds that on the sheltered Howth coasts *Hildenbrandtia* has the same general distribution as the lower Verrucarias, extending throughout neap range and being most conspicuous and best developed nearer low-water mark, while the other Verrucarias form a more continuous growth on the upper part of the shore. The red or yellowish-red crusts of *Hildenbrandtia* form such a striking contrast in colour to the green and blackish-green thalli of the Verrucarias that it is comparatively easy to trace their distribution. They seem rather to form two overlapping belts, *Hildenbrandtia* ascending the beach and extending its range upwards under the protection of the larger algae or by occupying the bottoms of shallow pools or the cracks and crevices in the rocks, while the Verrucarias on the other hand take advantage of every bare spot to penetrate further towards the sea, in the lowest parts colonising those projections which are first exposed to sun and air as the tide retreats.

The Carboniferous limestone rocks show a very poor lichen vegetation as compared with the Cambrian strata, the lichens so common on the latter being almost absent from the limestone, while the prevailing limestone forms are three species not found on the silicious rocks—*Arthrogyrenia litoralis*, *A. foveolata* and *Verrucaria Lorrain-Smithii*. There are no Ramalinas, but this is most likely due to the absence of high rocks; the orange lichens are represented only by a few spots of *Placodium calopisma* and *Lecanora citrina*; *Verrucaria maura*, and all species with gelatinous thallus, were entirely absent above half-tide, with the exception of a few spots of *V. aquatilis* growing in weathered hollows on tops of rocks above high-water mark. The absence of gelatinous species from the upper part of the shore may be due to the fact that calcareous rocks dry up much more quickly and are more easily heated than silicious strata. The surface of the apparently bare rocks along the top of the beach at about high neap-tide level were seen when examined with a lens to be thickly dotted with the little black fruits of Arthrogyrenias, the thin thalli of which appear to have colonised literally every inch of bare rock throughout the whole neap range; *A. foveolata* is more usual on rocks in the upper levels and on flat surfaces, its sunken perithecia being better adapted to withstand drier conditions, while *A. litoralis* which has prominent perithecia is less general in the upper part of the beach and grows most often on the sides of the rocks and in more shade: nearer low-water mark, both species grow on the most exposed surfaces, and both occur freely on barnacle shells as well as on rock. The Verrucarias of the silicious rocks are represented on the limestone only by *V. mucosa* and *V. microspora*, which are absent from the upper part of neap range and only appear about the middle of the *Fucus serratus* belt as thin patches here and there under the shade of the algae; they extend down the shore as far as low water and are most usual on the harder dolomites. The new species *V. Lorrain-Smithii*, associated with them near low water, is very inconspicuous, with very thin and sometimes evanescent thallus and minute perithecia.

Terricolous lichens are not very abundant on the Howth coast, and though in some places they cover fairly large areas the number of species is small; the Cladonias are much the most frequent forms. The only habitat for corticolous forms is a blackthorn scrub, on which the lichen growths are nowhere abundant or vigorous, but showed a tendency to occur in strata, the Ramalinas (*R. fastigiata*, *R. fraxinea*, *R. intermedia*) and *Evernia prunastri* being more usual on the scrub of the upper part of the bank, while the Physcias and crustaceous species are more common on the thickets in the lower reaches.

By the courtesy of the Royal Irish Academy we are enabled to reproduce some of the fine illustrations (Plates XIX—XXI) accompanying this memoir.



Phot.

R. Welch

FIG. 1. *Ramalina scopulorum*.
Ramalina Belt. Lower fertile zone.

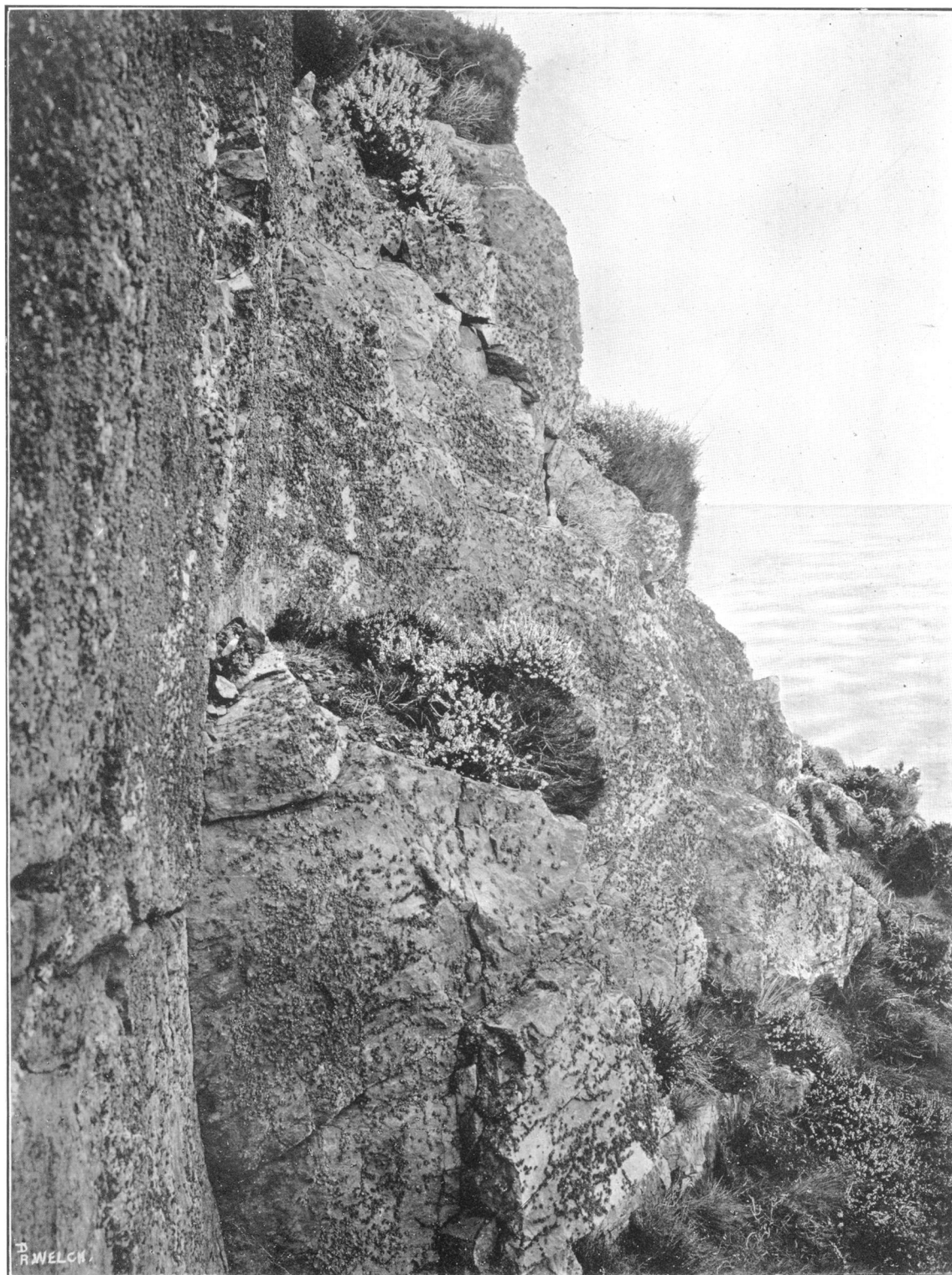


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FIG. 2. *Ramalina A.*
Ramalina Belt. Upper barren zone.

KNOWLES—MARITIME AND MARINE LICHENS (see pp. 134—138).



Phot.

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Ramalina B. On the quartzite cliffs at Red Rocks. [Note the absence of crustaceous lichens.]

KNOWLES—MARITIME AND MARINE LICHENS (see pp. 134—138).



Phot.

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Lecanora atra (grey patches), and *Buellia ryssolea* (dark patches), in the *Ramalina scopulorum* Belt.

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