

## LICHENS OF WHALE (MOTUHORA) AND RURIMA ISLANDS, BAY OF PLENTY, NEW ZEALAND

by Bruce W. Hayward<sup>1</sup> and Glenys C. Hayward<sup>2</sup>

<sup>1</sup>New Zealand Geological Survey, P.O. Box 30368, Lower Hutt

<sup>2</sup>Sacred Heart College, Lower Hutt

### SUMMARY

One hundred and fifty-seven lichen species from 63 genera are recorded from Whale (144 species) and Rurima (47 species) Islands, Bay of Plenty. This floristic diversity is less than many similar sized northern offshore islands with more mature and diverse forest cover, but comparable to the eastern Bay of Islands and Cavalli Islands which, like Whale, have young coastal forest regenerating after recent removal of grazing stock. The lichen communities are briefly described. *Diploschistes actinostomus*, *Hypotrachyna immaculata*, *Hypotrachyna* sp. B sensu Krog, *Parmelina conlabrosa* and *Parmelina subfatiszens* are additions to the New Zealand lichen flora, and a further 9 species, mostly crustose, are second records for New Zealand.

### INTRODUCTION

The lichens recorded here were collected during the Offshore Islands Research Group trip to Whale Island, December 29 - January 5 1986 (B.W.H., G.C.H.) and a Wildlife Service trip to Whale Island and Rurima Island, February 29 - March 3 1984 (B.W.H.). A small number of lichen genera had previously been recorded by one of us (G.C.H.) from Whale Island, following the Auckland University Field Club Scientific Trip in August 1970 (Puch 1971).

Whale Island (143 ha) lies in the Bay of Plenty, 11 km NNW of Whakatane. The two small Rurima Islands (Rurima - 6 ha, Moutoki - 1.5 ha) lie 8 km further west (Fig. 1). Rurima Island consists of two, pohutukawa (*Metrosideros excelsa*) and petrel scrub (*Hymenanthra novaezelandiae*) covered knobs, reaching a maximum height of 50 m. They are joined by an area of partially vegetated sand dune and surrounded by moderately soft sandstone and conglomerate reefs and maritime rocks.

Whale Island is 2.4 km east to west and nearly 1 km wide, rising to a maximum height of 353 m. It has high rocky cliffs along the northern side (Fig. 2) and low cliffs separated by three sandy beaches along the southern coast. The main central part of the island comprises the remaining southern half of a steep-sided volcanic cone. It is separated from a flat-topped eastern promontory by sand-filled McEwans Valley. To the west, the base of the main cone is bordered by a weakly active geothermal area in Sulphur Valley. The western end of the island consists of steep-sided Pa Hill, drained to the south east by Camp Valley and fringed to the south by a swamp and sand dunes at the back

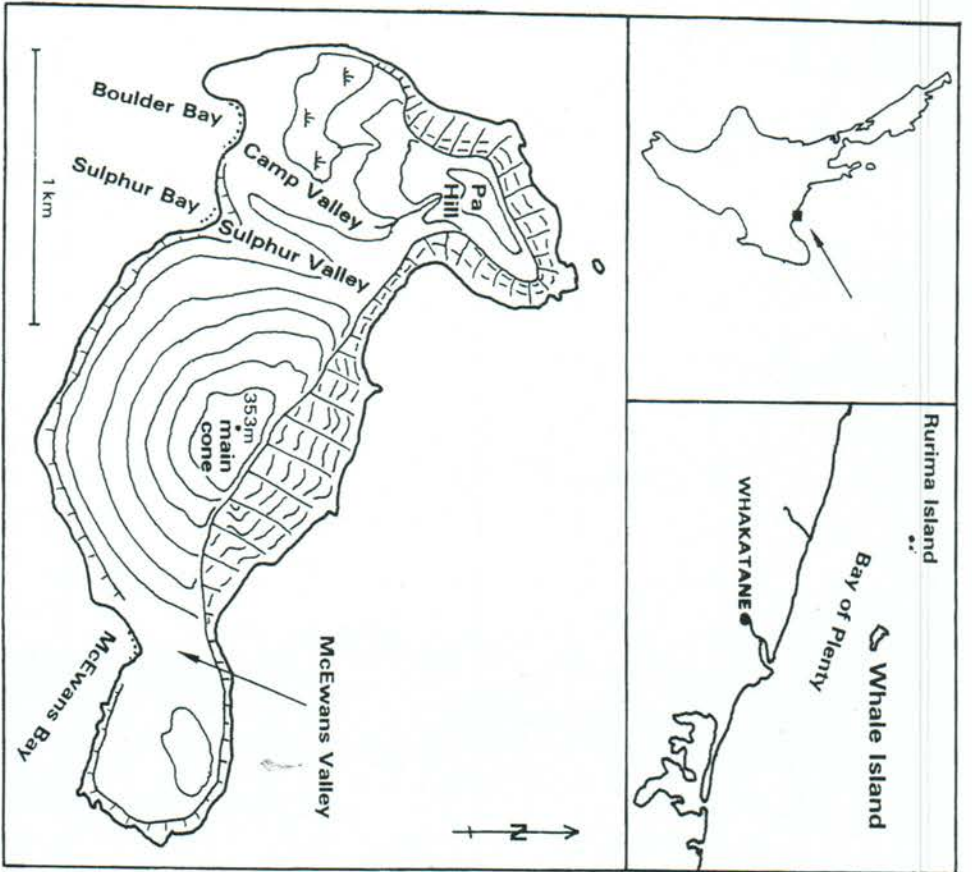


Fig. 1. Whale and Rurima Islands are located in the Bay of Plenty, North Island, New Zealand. Map of Whale Island with contours in 50m intervals.

of Boulder Bay (Fig. 2).

The vegetation of Whale Island was largely removed by prehistoric Maoris and later European farming activity. Regeneration began on Pa Hill and the cliffs, but was suppressed elsewhere by grazing goats and rabbits until their removal in the early 1970's and mid 1980's respectively.

At the time of our visit, the slopes of many parts of Whale Island were in dense, 1-4 m tall, regenerating teatree (*Kunzea*), pohutukawa and bracken (*Pteridium esculentum*), with little or no lichen flora. Remnant patches

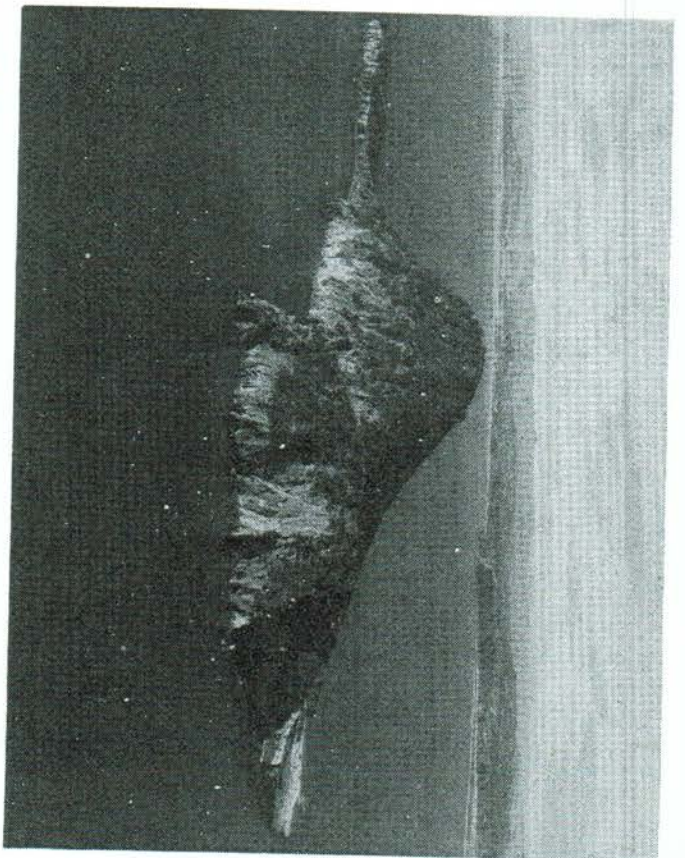


Fig. 2. Oblique aerial view of Whale Island from the north-west showing steep cliffs of Pa Hill (foreground), the kanuka - and pohutukawa-clad main cone (centre) and the low, flat-topped eastern promontory (left). Sand dunes behind Boulder Bay are visible on the far right. (Photo: D.L. Homer, NZ Geological Survey).

of grassland were still present around parts of Camp Valley. Mature pohutukawas line the cliffs and have moderate lichen cover, but the best developed forest lichens occur in the more advanced mixed forest of Pa Hill and in a clump of mature mahoe (*Melicope ramiflora*) and pohutukawa forest on the often cloud-shrouded summit of the main cone.

#### SPECIES LIST

Representative lichen collections and observations were made in the main macrohabitats. Specimens are housed in the herbarium of the Auckland Institute and Museum (AK). Classification follows Poelt (1974) and nomenclature for listed taxa follows Galloway (1985), except where otherwise stated.

Key to distribution symbols :

Habitat	Substrate
1 marine intertidal	b = bark
2 maritime	l = logs
3 sand dunes	r = rock
4 petrel scrub	s = soil
5 pohutukawa forest	
6 coastal cliff top	
7 open grassland	
8 <i>Stryphelia</i> sward	
9 kanuka scrub	
10 cabbage tree grove	
11 ngaito grove	
12 mixed forest, Pa Hill	
13 mahoe-pohutukawa forest, summit	
14 geothermal area, Sulphur Valley	

All records are for Whale Island unless prefixed by R = Ruima Island.

CLASS ASCOMYCOTINA

ORDER ARTHONIALES

Chytridiaceae *Chytrorhiz* *candelaris*

Opgraphaceae *Opgrapha* *cinerea*

*E. entroglypha* *gelatinosa*

*E. subgelatinosa*

*Opographa* *diaphoriza*

3b,6b,9b  
5b  
5b;R(5b)  
2r  
2r

Pleosporaceae *Arthropryrenia* *subtilioralis*

*Verrucariaceae* *Verrucaria* *naura*

*Clathroporiniaceae* *Clathroporina* *exocha*

*Caliciaceae* *Calicium* *hyperbelloides*

*Thelotremataceae* *Diploschistes* *actinostomus* (Pers in Ach.) Zahlbr.

*Thelotrema* *lepidinum*

*T. cf. saxatile*

*Graphidiaceae* *Graphina* *subvelata*

*Phaeographis* *australiensis*

*P. inusta*

*Bacidiaceae* *Bacidia* *buchananii*

*B. wellingtonii*

*Catillariaceae* *Catillaria* *melanotropia*

*Cladiaceae* *Cladia* *aggregata*

*Acarosporaceae* *Acarospora* *schlechteri*

*Acarospora* 2 spp.

*Cladonia* *Cladonia* *confusa*

*Cladonia* cf. *borbonica*

<i>C. capitellata</i>	3s,5r,6s,10r
<i>C. cf. cenotea</i>	R(31)
<i>C. cervicornis</i> ssp. <i>verticillata</i>	3s,7r
<i>C. chlorophaea</i>	6s
<i>C. coniocraea</i>	R(31)
<i>C. corniculata</i> Ahti & Kashwadani	5r,9s
<i>C. didyma</i>	51r,6r,14r
<i>C. enantia</i>	9s
<i>C. floerkeana</i>	5r,7r;R(31)
<i>C. furcata</i>	3s,5r
<i>C. gracilis</i> ssp. <i>tenerrima</i>	7r
<i>C. krempehuberi</i>	9s
<i>C. ochrochlora</i>	31,5r;R(31)
<i>C. polycarpoides</i> Nyl.	3s,9s
<i>C. praeternissa</i>	5s
<i>C. rei</i>	3s,7rs
<i>C. scabriscula</i>	3s,8s,9s
<i>C. turgida</i>	R(31)
<i>Cladonia</i> spp.	3s,51r,7s,14rs
<i>Gymmodermia melaleucarpum</i>	13b,14b
<i>Collema</i> <i>Collema</i> <i>kauiense</i>	11b
<i>C. laeve</i>	10b,11b
<i>Leptogium</i> <i>azureum</i>	5rs
<i>L. brevissonii</i>	10b,11b
<i>L. cyanescens</i>	13r
<i>Hypogymniaceae</i> <i>Hypogymnia</i> <i>subphysodes</i>	2r,5b,7r,9b,14b
<i>Lecanoraceae</i> <i>Lecanora</i> <i>campestris</i>	7r
<i>L. flavopallida</i>	12b,14b
<i>Lecanora</i> cf. <i>proprior</i>	4b
<i>L. strobilina</i>	5b;R(31,4b)
<i>Lecanora</i> sp.	2r
<i>Lecideaceae</i> <i>Lecidea</i> <i>fuscocincta</i>	3b
<i>Phylloporina</i> <i>microdactyla</i>	13b
<i>Lichniaceae</i> <i>Lichina</i> <i>confinis</i>	1r
<i>Lobariaceae</i> <i>Pseudocyphellaria</i> <i>aurata</i>	5b,10b,11b
<i>P. coriacea</i>	5b,13r
<i>P. crocata</i>	5rs,11b,13r
<i>P. dissimilis</i>	13r
<i>P. episticta</i>	13r
<i>P. flavicans</i>	13r
<i>P. psilophylla</i>	12r,13r
<i>P. subvariabilis</i>	13r
<i>Sicia</i> <i>fuliginosa</i>	13r
<i>S. squamata</i>	5brs,13r
<i>Megalariaceae</i> <i>Megalaria</i> <i>grossa</i> (Pers.) Hatellner	12b
<i>Megalosporaceae</i> <i>Megaloblastenia</i> <i>flavidoatra</i>	5b
<i>Micrareaceae</i> <i>Micareu</i> sp.	5s
<i>Pannariaceae</i> <i>Erioderma</i> <i>sorediatum</i>	9b
<i>Pannaria</i> <i>crustata</i>	6s
<i>P. elatior</i>	5r
<i>P. fulvescens</i>	9b
<i>P. gemmascens</i>	10b
<i>P. subimixta</i>	2r
<i>Parmeliaceae</i> <i>Flavoparmelia</i> <i>haysonii</i>	2r,7r

<i>F. sorelians</i>	
<i>Hypotrachyna formosana</i>	2r,3b,7r,9b,10b;R(2r,3l,6r)
<i>H. immaculata</i> (Kurok.) Hale	2r,5b,9b,14b
<i>H. sp. B sensu Krog</i>	2r
<i>Hypotrachyna</i> sp.	2r
<i>Neofuscocella pulia</i>	2r,7r;R(3l,5r)
<i>Pannoparmelia wilsonii</i>	14b
<i>Parmelia erumpens</i>	R(5b)
<i>Parmelia novaezealandiae</i>	R(5r)
<i>Parmelia contabrosa</i> (Hale) Elix & Johnston	3b,5b,14b
<i>P. horrescens</i>	2r
<i>P. subglaucescens</i> (Kurok.) Hale	2r,9b
<i>Parmotrema cetratum</i>	2r,5b,6r,7r,9b,10b,11b,13r;R(5b)
<i>P. crinitum</i>	3b,5b,9b,10b
<i>P. mellissii</i>	5b,7r,9b,10b,12b
<i>P. perlatum</i>	3b,5b,8b,9b;R(2r)
<i>P. reticulatum</i>	2r,3b,5b,7r,9b,10b,13r;R(2r,3lr,5r,6r)
<i>P. subinctorum</i>	5b,10b;R(2r)
<i>P. tinctorum</i>	5br;R(2r,5br)
<i>Punctelia borveri</i>	R(5b)
<i>P. rudecta</i>	13r
<i>P. subrudecta</i>	9b
<i>Xanthoparmelia australasica</i>	2r,7r;R(2r,3l,6r)
<i>X. flavescens</i>	6r,5r,7r
<i>X. furcata</i>	3r;R(6r)
<i>X. neotinctina</i> (Elix) Elix & Johnston	2r,7r
<i>X. scabrosa</i>	2r,5r,6r,7r;R(2r,3lr,6r)
<i>Peltigeraceae Peltigera dolichorhiza</i>	5r,9s
<i>Pertusariaceae Pertusaria leucodeoides</i>	12b
<i>P. sorodes</i>	5b
<i>Pertusaria</i> sp.	9b
<i>Physciaceae Buellia alutacea</i>	2r
<i>B. citrina</i>	14r
<i>B. cf. litoralis</i>	2r
<i>B. olagensis</i>	6r
<i>B. punctata</i>	3b;R(3l)
<i>B. spuria</i>	R(6r)
<i>B. stellulata</i>	7r;R(6r)
<i>Diplolcia canescens</i>	2r;R(2r,5r)
<i>Dirinaria appianta</i>	12b
<i>D. picta</i>	3b,5br,12b;R(5b)
<i>Heterodermia isidiophora</i> (Nyl.) Awashi	13r
<i>H. japonica</i>	5r,13r;R(3l)
<i>H. leucomelos</i> ssp. <i>boryii</i>	13r
<i>H. obscurata</i>	2r,5br,11b,13r;R(2r,3r,5r,6r)
<i>H. speciosa</i>	3l,6r,7r,11b;R(2r,3r,4b)
<i>Physcia caesia</i>	R(5r)
<i>P. tribrachioides</i>	10b,13br;R(2r)
<i>Pyxine subcinerea</i>	11b
<i>Rinodina</i> sp.	2r,7r
<i>R. tubulata</i>	2r,6r,7r
<i>Placynthiaceae Psoroma athroophyllum</i>	13r
<i>Porpidiaceae Porpidia albocærulescens</i>	7r;R(5r)

<i>P. macrocarpa</i>	5r,7r,12r
<i>Ramalinaceae Ramalina celastri</i>	2r,5br,6br,7r,9b,10b;R(3r,4b,6r)
<i>R. peruviana</i>	6r,9br,13br;R(2r,5b)
<i>Stereocaulaceae Stereocaulon ramulosum</i>	2r,5r,7r;R(5r)
<i>S. vesuvianum</i>	7r
<i>Teloschistaceae Caloplaca cf. litoralis</i>	2r
<i>C. mooreae</i>	R(3l)
<i>Teloschistes chrysophthalmus</i>	R(4b,5b)
<i>T. sieberianus</i>	10b
<i>Xanthoria ligulata</i>	2r,6r,7r;R(3r)
<i>X. parietina</i>	2r,7r;R(2r,3r,4b,6r)
<i>Trapetaceae Placopsis gelida</i>	7s
<i>Trapelia coarctata</i>	13r
<i>Usneaceae Usnea arida</i>	2r,5br,7r,8b,11b,14b;R(2r,3l,5b,6r)
<i>U. capillacea</i>	5r
<i>U. inermis</i>	2r,5br,10b;R(5br,6r)
<i>U. rubicunda</i>	2r,5br,7r,8b,10b,14b
<i>U. societatis</i>	2r,5br,10b,14b
<i>U. torquescens</i>	2r,5r;R(2r)
<i>U. xanthophana</i>	10b
<i>Usnea</i> spp.	9b,10b,14b;R(5b)
<i>Leptocaulon arbuscula</i>	7r

#### CLASS DEUTEROMYCOTINA

#### LICHEN COMMUNITY AND HABITAT NOTES

##### Marine

The soft, rapidly eroding reefs of Rurima Island do not support any intertidal lichens, but the much harder, massive blocks of lava that occur intertidally around many parts of Whale Island support clumps of stubby *Lichina confinis* and patches of crustose *Verrucaria maura*. Black, crustose *Arthopyrenia subtilioralis* grows over intertidal barnacles.

##### Maritime rocks

The lichen flora of maritime rocks on both Rurima and Whale is dominated by *Parmotrema reticulatum*, *P. cetratum*, *Heterodermia obscurata* and *H. speciosa* with locally abundant *Xanthoparmelia australasica*, *X. scabrosa*, *Xanthoria parietina*, *Ramalina celastri* and *Caloplaca* spp.

##### Sand dunes

Several habitat opportunities exist for colonisation by lichens in the coastal sand dunes on Rurima and Whale Islands. Flotsam logs in the sand dunes of Rurima support a diverse lichen flora with a mix of foliose *Parmeliaceae* (eg. *Flavoparmelia sorelians*, *Neofuscocella verrucella*, *Parmotrema reticulatum*, *Xanthoparmelia australasica*, *X. scabrosa*) and crusts (eg. *Buellia punctata*, *Caloplaca mooreae*, *Lecanora strobilina*) and on rotting parts, a number of *Cladoniaceae*.

Stunted, windswept kanuka on the fringes of eroding blow-outs in Whale Island dunes, have a lichen flora dominated by foliose *Dirinaria picta*, *Parmotrema crinitum* and *P. reticulatum*, with a number of less common foliose and crustose taxa. Nearby damp hollows in lupin-covered dunes support a variety of ground-dwelling *Cladonia* species.

#### **Petrel scrub**

Twigs and branches of *Hymenanthra* and *Coprosma*, that dominate the petrel scrub on Rurima Island, have a sparse lichen flora, mostly of yellow *Xanthoria parietina* and yellow *Teloschistes chrysophthalmus*.

#### **Pohutukawa forest**

The rough bark of the abundant pohutukawa trees on Rurima and Whale Islands has a lichen flora dominated by foliose *Parmotrema tinctorum*, *P. cetratum*, *Hypotrachyna formosana*, *Hypogymnia subphysodes* and pendulous *Usnea arida* and *Ramalina celastri*. Crustose taxa are neither abundant nor diverse on the rough bark but close scrutiny located six identifiable taxa (in decreasing abundance) - *Lecanora strobilina*, *Enterographa gelatinosa*, *Catillaria melanotropia*, *Pertusaria sorodes*, *Megaloblastenia flavidoatra*, *Dicryograppha cinerea*.

#### **Coastal cliff tops**

Rocks on open cliff tops or beneath semi-open canopied pohutukawas on the cliffs have a rich and diverse lichen cover.

The more common taxa present include fruticose *Ramalina celastri*, *R. peruviana*, *Usnea arida*, *U. inermis*, *Stereocaulon ramulosum* and foliose *Parmotrema tinctorum*, *Xanthoparmelia australasica*, *X. flavescens*, *X. furcata*, *X. scabrosa*, *Heterodermia obscurata*, *H. japonica*, *H. speciosa*, *Physcia caesia* and *Diploicia canescens*. The dominant crustose taxa are *Buellia* (*B. otgensis*, *B. spuria*, *B. stellulata*).

Lichens occur patchily on the partly shaded cliff top soil. These are dominantly *Cladia aggregata* and *Cladonia* species but in damper places include foliose *Peltigera dolichorhiza*, *Leptogium azureum*, *Pannaria crustata*, *Xanthoparmelia flavescens*, *Pseudocyphellaria crocata*, *Sitica squamata* and the crusts *Bacidia buchani* and *Micarea* sp.

#### **Open grassland**

The numerous rocky knolls and low bluffs within the remaining open grasslands around Camp Valley and the top of the main cone on Whale Island have rich foliose and crustose lichen cover. The dominant forms are yellow-green *Xanthoparmelia scabrosa* and *X. flavescens*. Also common are *X. neolinctina*, *X. australasica*, *Flavoparmelia haysonii*, *Neofuscella pulla*, *N. verrucella* and *Parmotrema reticulatum* - all Parmotremaceae. *Stereocaulon ramulosum*, *Cladia aggregata* and *Cladonia* species are also common on these

rocks and on the surrounding soil.

#### **Styphelia sward**

An unusual area of 5-8 cm high *Styphelia fraseri* sward and grasses occurs on an open hillside behind Boulder Bay. *Usnea rubicunda* and *U. arida* are common on the woody branchlets and *Cladonia scabriscula* grows on the soil beneath.

#### **Kanuka scrub**

Most of the kanuka scrub on Whale Island is vigorous and young with a dense canopy and is virtually devoid of lichens. There are a few patches of more mature, open-canopied kanuka on the slopes of the main cone that support a sparse lichen flora. It is dominated by *Parmotrema cetratum*, *P. perlatum*, *P. reticulatum*, *P. mellissii*, *P. crinitum* and *Usnea* spp.

#### **Cabbage tree groves**

Groves of cabbage tree (*Cordyline australis*) are common on the eastern promontory of Whale Island. Whereas the narrow tall trunks of many are bare, some of the largest ones are thickly covered in foliose *Parmotrema subtinctorum*, *Parmotrema reticulatum*, *Physcia tribacioides*, *Collema laeve* and fruticose *Usnea inermis* and *U. societalis*.

#### **Ngaio grove**

A small grove of ngaio (*Myoporum laetum*) on the eastern end of Whale Island has a semi-closed canopy with low light penetration. The gnarled ngaio bark supports a variety of shade lichens (eg. *Leptogium brebissonii*, *Collema laeve*, *C. kaniense*, *Pyxine subchenera*, *Pseudocyphellaria crocata*) and on outer branches more light tolerant taxa (eg. *Parmotrema cetratum*, *Heterodermia obscurata*, *H. speciosa*).

#### **Mixed forest, Pa Hill**

The moderately dry, mixed coastal forest on the eastern slopes of Pa Hill, Whale Island has a moderate lichen flora with many of the elements of the pohutukawa flora. In addition the smooth bark of mahoe has many additional crustose taxa (eg. *Graphina subvelata*, *Phaeographis musta*, *Lecanora flavopallida*, *Megalania grossa*, *Pertusaria leucodeoides*).

#### **Mahoe-pohutukawa forest, summit of Whale Island**

A half hectare clump of mature mahoe-pohutukawa forest grows among large boulders on the 350 m high summit of Whale Island's main cone. Because of the cloud that often hangs around the summit, this is the dampest forest on the island and as a result is the only habitat with well developed Lobariaceae. The diverse forest lichen flora is largely confined to the rocks and mahoe around its fringes. Five species of Lobariaceae are only recorded from here, as well

as *Psoroma athrophyllum*, *Punctelia rudecta*, *Heterodermia isidiophora*, *H. leucomelos boryii* and *Trapelia coarctata*.

#### Geothermal area, Sulphur Valley

Within the hot, open, sinter area, swept by sulphur-rich fumes, only a few andesite boulders are colonised by lichens. These are small crusts, specifically lemon yellow *Acarospora schleicheri* and *Buellia cirrina* and an unidentified black crust. In New Zealand, *A. schleicheri* has previously only been reported from dry higher altitude parts of the South Island.

Surrounding the active geothermal area, the kanuka is stunted and open. Here the bark and scattered rocks have a lichen flora dominantly of *Hypogymnia subphysodes* and *Usnea* spp. with common *Parmelina conlabrosa*. On the rocky soil beneath, *Cladia aggregata* and *Cladia confusa* are frequent.

#### FLORISTIC DIVERSITY

In this paper we record 47 lichen species in 24 genera from Rurima Island and 144 species in 62 genera from Whale Island, which combined is 157 species in 63 genera from the group of islands. This floristic diversity is of a similar order to that of other well-studied northern offshore islands, such as Three Kings Islands (170 species in 81 genera, Galloway and Hayward 1987), Poor Knights Islands (132 species in 52 genera, Hayward and Hayward 1982 and unpubl.), and Hen and Chickens Islands (156 species in 58 genera, Hayward and Hayward 1978, 1984).

This comparison however, obscures the truth. With the publication of Galloway (1985), it has been possible to identify a far greater proportion of the crustose lichens from Whale and Rurima Islands than in other previous studies. Thus in reality, the diversity of the macrolichens of Whale and Rurima Islands is lower than many comparable sized northern islands. This results from the youth, low diversity and relative dryness of the regenerating Whale Island forest compared with most other island groups, and reflects the short time since grazing animals (goats) were removed. The macrolichen diversity on Whale and Rurima Islands is of similar order to two other recently grazed island groups - the Cavalli Islands (85 species in 39 genera, Hayward and Hayward 1979) and eastern Bay of Islands (111 species in 43 genera, Hayward and Hayward 1980).

#### NEW AND SIGNIFICANT RECORDS

Five species recorded here from Whale Island are new records for New Zealand, and are not listed in Galloway (1985) or subsequent publications. These are: *Diploschistes actinostomus*, *Hypotrachyna immaculata*, *Hypotrachyna* sp. *sensu* Krog, *Parmelina conlabrosa*, and *Parmelina subfatiszens*.

This paper also contains the second record of six endemic crustose species

previously known only from their type collections (*Buellia alutacea*, *Buellia cirrina*, *Buellia oligensis*, *Enterographa subgelatinosa*, *Lecanora fuscescens*, *Thelotrema* cf. *saxatile*), and the second New Zealand record of three cosmopolitan species (*Buellia spuria*, *Heterodermia isidiophora*, *Pyxine subcinerea*).

These Whale and Rurima Islands records extend the known northern limits of seven species (*Acarospora schleicheri*, *Bacidia wellingtonii*, *Cladonia didyma*, *Cladonia rei*, *Pannaria crustata*, *Phylloporosa microdactyla*, *Punctelia rudecta*) and extend the southern range of ten northern species (*Cladonia polycarpoides*, *Dirinaria picta*, *Lecanora strobilina*, *Leprocaulon arbuscula*, *Leptogium breibssonii*, *Pannaria elatior*, *Parmelina horrescens*, *Parmotrema tinctorum*, *Usnea societatis*, *Xanthoparmelia furcata*).

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