LICHENOGRAPHIA THOMSONIANA: NORTH AMERICAN LICHENOLOGY
IN HONOR OF JOHN W. THOMSON.
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LICHENS OF THE SPIRIDON PENINSULA, WESTERN KODIAK ISLAND, ALASKA, WITH OBSERVATIONS ON LICHEN COMMUNITIES

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Abstract

One hundred twenty nine taxa of lichens are reported from western Kodiak Island, Alaska, where the lichen flora is little known. One species, *Porina lectissima* is new to Alaska. The lichen flora of western Kodiak Island falls into six ecological-geographic categories, with the majority of species falling into alpine-subalpine, coastal, and wet interior categories. Vegetation data from 266 relevés are classified into 31 community types using minimum variance clustering. Nine epigeaic and two epilithic community types had significant lichen components. Twenty-two epiphytic lichens from *Alnus crispa*, *Betula kenaica*, *Salix* spp., and *Populus trichocarpa* are enumerated from 28 relevés.

Introduction

Situated along the northwestern border of the Gulf of Alaska, Kodiak Island (9,300 km^2), occupies an important biogeographical position (Fig. 1). The island has biogeographic relationships that radiate in three directions: westward along the Aleutian Islands, northward toward interior Alaska, and southeastward toward the temperate Pacific Coast and Rocky Mountain regions of North America (Vincent 1964).

This paper reports lichens collected on the Spiridon Peninsula, which is located in Kodiak National Wildlife Refuge on the west central coast of Kodiak Island. Hitherto the lichen flora of Kodiak Island has received only minor attention and there are no published reports for the Spiridon Peninsula. Previous reports for Kodiak Island are found in Cummings (1910), Degelius (1937), Gowan (1989), Hedrick (1936), Kärnefelt (1979), Krog (1969), Rothrock (1884), and Thomson (1984). There are no published studies of the lichen communities of Kodiak Island. The objectives of the present paper are to (1) record the lichens from a spectrum of habitats in the Chief Cove area, western Spiridon Peninsula, and (2) determine lichen species of high presence within the plant communities.

Study area

The study encompasses about 5.2 ha of the Chief Cove area (54° 44'N, 153° 56'W) in the northwestern corner of the Spiridon Peninsula. The study area is dominated by rugged mountainous terrain, with rounded summits rising to 630 m, and rolling lowlands. The climate of the region is maritime. Based on climatic records from Larsen Bay (57° 32'N, 154° 00'W), located 20 km south of Chief Cove, the mean annual temperature is 4.4°C and the mean annual precipitation is 575 mm (Leslie 1989). Using an ecoclimatic-phytogeographical system, Tuhkanen (1984) included Kodiak Island in the middle boreal, hyperoceanic (O_2), perhumid region.

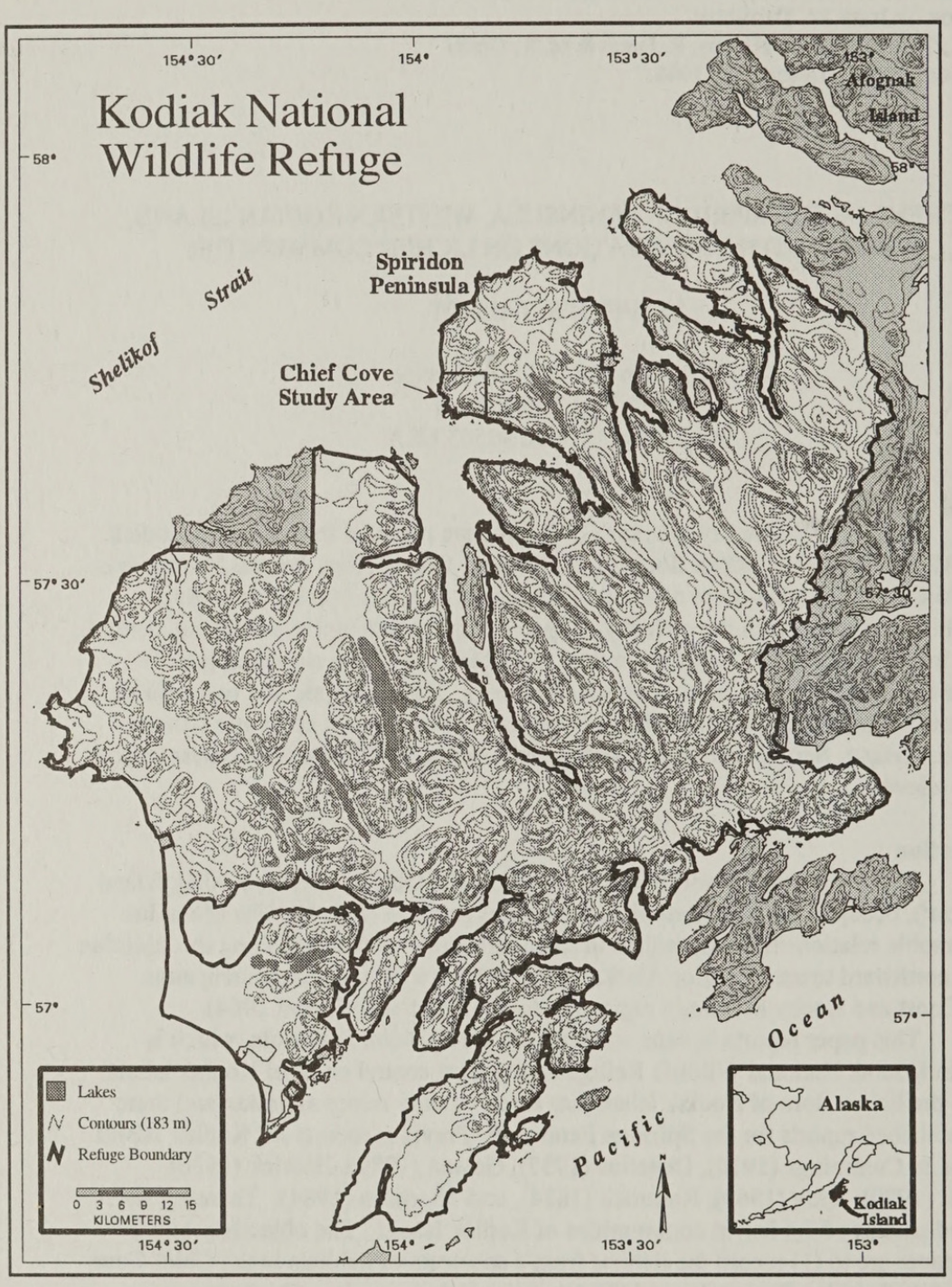

Figure 1. Location of the Spiridon Peninsula and the Chief Cove study area on Kodiak Island, Alaska.

Bedrock geology within the study area is characterized by stratified sedimentary rocks (Beikman 1980). The most widespread rocks are of Lower Cretaceous and Upper Jurassic (KJ_3) age. These rocks are a melange of flysch, greenstone, limestone, chert, granodiorite, greenschist, gabbro, and serpentenite. Upper Cretaceous (uK) rocks with graded beds of sandstone and slate occur within a small portion of the southeast corner of the study area.

The surficial geology of the Spiridon Peninsula is dominated by coarse rubbly deposits associated with steep-sloped mountains with high percentage of bedrock exposures (Karlstrom et al. 1964). The dominant soils are Dystric Cryandepts and Dystric Lithic Cryandepts (Rieger et al. 1979); these are Inceptisols formed in volcanic ash. The most recent ash fall occurred when Mount Katmai erupted in 1913, depositing approximately 30 cm of ash on the Spiridon Peninsula (Wilcox 1959). Griggs (1918) detailed vascular plant recovery following the eruption and included notes on some mosses but made no mention of lichens.

The vegetation of the region is described by Griggs (1936) but does not include lichen species. From my field observations, the vegetation of the Chief Cove area is lush with the herbaceous species of closed, lowland meadows attaining a height of 1-2 m. The vegetation of the study area may broadly be divided into three primary types: 1) forest communities of *Betula kenaica* and *Populus trichocarpa* are minor components of the lowlands, 2) thickets of *Alnus crispa*, *Rubus spectabilis*, *Salix* spp., and *Sambucus racemosa* and tall graminoid and forb meadows of *Calamagrostis canadensis*, *Epilobium angustifolium*, and *Geranium erianthum* predominate from lower through middle elevations, and 3) dwarf shrub heaths of *Empetrum nigrum*, *Rhododendron camtschaticum*, and *Arctostaphylos alpina* occur at upper elevations. Mires form a minor component and occur in isolated depressions and along streamlets.

The ten most frequently occurring vascular plants within the study area are listed in order of decreasing importance *Calamagrostis canadensis*, *Equisetum arvense*, *Epilobium angustifolium*, *Athyrium filix-femina*, *Angelica lucida*, *Heracleum lanatum*, *Trientalis europaea*, *Rubus spectabilis*, *Sanguisorba stipulata*, and *Veratrum viride*.

Methods

Field studies

Field studies were conducted during July and August 1990 with collections from 67 localities. All determinations were made by John W. Thomson. Voucher specimens are deposited in the University of Wisconsin Herbarium (WIS). Nomenclature follows Esslinger & Egan (1995).

The primary purpose of the work on the Spiridon Peninsula was to conduct a phytosociological study of the plant communities based on a set of 266 relevés. Plots were laid out in units of homogeneous vegetation so as to represent the totality of the environmental variation. Quadrat size was 100 m^2. Cover-abundance was estimated for vascular plants and lichens according to the 9-point ordinal scale of Westoff & van der Maarel (1973): 1, one or few individuals; 2, occasional and <5% cover of total plot area; 3, abundant and with very low cover, or less abundant but with higher cover; in any case <5% cover; 4, very abundant and <5% cover; 5, 5-12.5% cover; 6, 12.5-25% cover; 7, 25-50% cover; 8, 50-75% cover; and 9, 75-100% cover. During the course of the vegetation study, lichen collections were made in relevés; additional lichen collections were made outside the relevés as I travelled on foot from lower to upper elevations.

In addition, twenty-eight qualitative relevés were also made of the epiphytic lichen communities on four host taxa over a range of environmental conditions from lowlands to middle mountain slopes: *Alnus crispa*, *Betula kenaica* (=*B. papyrifera* var. *kenaica*), *Salix* spp. [*S. glauca*, *S. pulchra* (*S. planifolia* subsp. *pulchra*), and *S. alaxensis*], and *P. trichocarpa* (*Populus balsamifera* subsp. *trichocarpa*); sampling

intensity was approximately proportional to the abundance of the woody species. An epiphytic relevé was the entire surface (base, trunk, or main stems as well as the crown and twigs) of an individual woody host species.

The major collection sites are listed below. Each site is followed by habitat information and elevation (m).

1. Moist *Empetrum nigrum-Salix arctica* heath, 630 m.
3. On *Alnus crispa* in *Alnus crispa-Calamagrostis canadensis* thicket, 24 m.
8. Dry *Festuca altaica-Salix arctica* dwarf shrub meadow, 396 m.
9. Very dry *Empetrum nigrum-Dryas integrifolia* barren, 463 m.
12. On *Betula kenaica* in moist *Betula kenaica-Athyrium filix-femina* coastal forest, 12 m.
14. On *Alnus crispa* in moist *Alnus crispa-Veratrum viride* thicket, 244 m.
15. Moist *Rosa nutkana-Athyrium filix-femina* open scrub, 290 m.
18. On *Alnus crispa* in moist *Alnus crispa-Veratrum viride* thicket, 256 m.
19. On *Salix pulchra* in moist *Salix glauca* thicket, 335 m.
31. On *Salix glauca* in *Salix glauca-Athyrium filix-femina* thicket, 30 m.
37. On *Salix alaxensis* in *Salix alaxensis* swamp thicket, 30 m.
39. On *Salix alaxensis* in *Salix alaxensis-Athyrium filix-femina* swamp thicket, 12 m.
40. On *Betula kenaica* in *Betula kenaica-Athyrium filix-femina* forest, 24 m.
41. *Betula kenaica-Calamagrostis canadensis* swamp forest, 30 m.
45. Same as #40 but at 35 m.
46. *Salix pulchra* in *Salix pulchra-Athyrium filix-femina* scrub, 35 m.
50. On *Alnus cripa* in *Alnus crispa-Rubus spectabilis* scrub, 259 m.
60. On *Populus trichocarpa* in open *Populus trichocarpa* forest, 3 m.
65. Epixylic on old salmon net drying rack, 1.2 m.
66. Epixylic on beached coastal log, 0.3 m.
68. On *Salix glauca* in *Salix glauca* thicket, 40 m.
70. Dry *Anemone narcissiflora-Arnica latifolia* low forb meadow, 591 m.
71. Dry *Empetrum nigrum-Salix stolonifera* lichen heath, upper NNW-facing upper mountain slope, 591 m.
72. Epilithic on pebbles in dry *Empetrum nigrum* fellfield, upper NNW-facing mountain slope, 567 m.
76. Dry *Empetrum nigrum-Loiseleuria procumbens* heath, 549 m.
77. Same as #76 but 561 m.
81. On *Salix bebbiana* in *Betula kenaica* forest, bench in coastal lowlands, 18 m.
88. On *Populus trichocarpa* in open *Populus trichocarpa* forest, 15 m.
90. On *Alnus crispa* in *Alnus crispa-Athyrium filix-femina* thicket, 18 m.
90A. On barnacle, sea level.
92. Same as #90 but 120 m.
97. On *Alnus crispa* in *Alnus crispa-Dryopteris austriaca* thicket, 381 m.
98. Moist *Empetrum nigrum-Hylocomium splendens* dwarf shrub heath, 463 m.
100. Very dry rock outcrop, 15 m.
102. On *Betula kenaica* in moist *Betula kenaica-Athyrium filix- femina* coastal forest, 37 m.
107. Same as #90 but 232 m.
113. Very dry rock outcrop on ridge crest of tor, 604 m.
118. Same as #90 but 250 m.
122. On *Alnus crispa* in moist *Alnus crispa-Veratrum viride* thicket, 29 m.
124. On *Betula kenaica* in moist *Betula kenaica-Calamagrostis canadensis* forest, 12 m.
126. Same as #90 but 12 m.
144. Dry *Empetrum nigrum-Loiseleuria procumbens* heath, 427 m.

151. Same as #88 but 30 m.
166. Epilithic in very dry escarpment grotto, 1.5 m.
167. Coastal very dry rock escarpment, 1.5 m.
168. Epilithic in coastal very dry rock escarpment grotto, 46 m.
169. Wet *Empetrum nigrum-Carex aquatilis* dwarf shrub mire, 286 m.
172. Moist *Salix pulchra-Lycopodium annotinum* thicket, 274 m.
182. On *Salix pulchra* in moist *Salix pulchra-Lycopodium annotinum* thicket, 162 m.
191. Moist *Festuca altaica-Solidago lepida* low meadow, 351 m.
194. Moist *Empetrum nigrum-Festuca altaica* hummocky heath, 381 m.
199. Moist *Angelica lucida-Festuca altaica* hummocky heath, 488 m.
200. Dry *Empetrum nigrum-Racomitrium* frost boil heath, 524 m.
201. On humus in dry scarcely vegetated fellfield, 518 m.
202. Epilithic on very dry rock tor, 610 m.
213. Dry *Cornus suecica-Festuca altaica* meadow, 396 m.
214. Dry *Rhododendron camtschaticum-Vaccinium vitis-idaea* heath, 433 m.
215. Dry *Empetrum nigrum-Racomitrium* heath, 555 m.
220. Moist *Geranium erianthum-Solidago lepida* meadow, 354 m.
223. Moist *Empetrum nigrum-Pleurozium schreberi* heath on ridge, 366 m.
246. Epilithic on very dry rock tor, 579 m.
247. Moist *Empetrum nigrum-Cladina* heath, 555 m.
256. Moist *Equisetum arvense* meadow, 140 m.
258. Moist *Salix barclayi* thicket, 134 m.
260. Wet *Equisetum arvense* meadow, 137 m.
262. Wet *Salix barclayi* thicket, 137 m.
263. *Epilobium angustifolium* meadow, 128 m.

Distributional categories are assigned to each taxon according to the ecological-geographic subdivisions of Noble et al. (1987) for British Columbia, supplemented by Goward et al. (1994), with an additional subdivision, **U**, for those species not in the Noble or Goward lists. Many of the lichens have combinations of the distributional categories. **A**, Alpine and Subalpine (high elevations throughout British Columbia, but especially north-central and northwest corner, primarily above timberline but including solitary stunted trees); **B**, Boreal (spruce region of northeast and north-central interior); **C**, Coastal Area (Queen Charlotte Islands, Vancouver island, Cascade Mountains strip on the adjacent mainland); **I(d)**, Dry Interior (semidesert, dry grasslands in central and southern interior, including the most open woodlands); **I(w)**, Wet Interior (forested areas in central interior and southern Rocky and Columbia mountains); **U**, Unclassified (species with distribution unknown; these are either under study, too poorly understood taxonomically for confidence in published maps, or not reported from British Columbia); and **W**, Widespread (present in many or most of the other locations).

Data analysis

Numerical analysis of plant communities was accomplished with the classification methods of the MULVA-5 package (Wildi & Orlóci 1996) using a numerical solution to traditional phytosociological tabular classification proposed by Wildi (1989). The procedure involves a number of operational steps detailed by Wildi (see above). Outliers were detected using an absolute measure for the definition of composition isolation of a relevé, via a similarity index, the similarity ratio (based on normalized relevé vectors) of any relevé with its nearest neighbor. At a similarity ratio of 0.4, ten relevés were excluded. The resulting matrix, 256 relevés X 223 species (vascular plants and lichens), was submitted to multivariate classification analysis. For relevé classification, minimum variance clustering (Orlóci 1978) was performed.

TABLE 1. Comparison of geographic distribution patterns of the Spiridon Peninsula and Tuxedni Wilderness Area, Alaska and British Columbia. Values indicate the presence of each taxon occurring within each category; many are combinations of these. Percentage values are in parentheses. Key: A = alpine and subalpine; B = boreal; C = coastal; I(d) = dry interior; I(w) = wet interior; U = unclassified; W = widespread; n = total number of lichen taxa.

Region	A	B	C	I(d)	I(w)	U	W
Spiridon (n = 129)	50 (39)	18 (14)	44 (34)	9 (7)	32 (25)	18 (14)	18 (14)
Tuxedni (n = 218)	77 (35)	42 (19)	93 (43)	23 (11)	70 (32)	6 (3)	31 (14)
BC (n = 1039)	165 (16)	59 (6)	553 (53)	116 (11)	288 (28)	127 (12)	46 (4)

Presence classes are: r, <3%; +, 3.1-10%; I, 10.1-20%, II, 20.1-40%; III, 40.1-60%; IV, 60.1-80%; V, 80.1-100%.

Results

List of lichens

One hundred twenty nine taxa of lichens were found on the western Spiridon Peninsula of Kodiak Island. Of these, 86 are new reports for Kodiak Island.

Distribution patterns for lichens from the Spriridon Peninsula are shown in relationship to Tuxedni Wilderness Area located in western Cook Inlet Alaska (280 km NNE of the Spiridon Peninsula; Talbot et al. 1992) and to British Columbia (Noble et al. 1987)(Table 1). Analysis of species distributions, in relation to ecological-geographic subdivisions of Noble et al. (1987), shows that Spiridon lichen taxa are most frequent in the alpine-subalpine, coastal, and wet interior subdivisions. This pattern is very similar to that of Tuxedni Wilderness Area. Many Spiridon lichen taxa, 29.4% (38) occur in more than one of Noble's subdivisions, but 20.1% (26) are entirely restricted to the coastal and 17.8% (23) to the alpine-subalpine categories.

In comparison to the lichen flora of British Columbia (Noble et al. 1987), the contribution of alpine-subalpine and boreal elements are higher for the Spiridon Peninsula and Tuxedni Wilderness. The dominant elements in British Columbia are coastal and wet interior.

The names of taxa not previously reported from Kodiak Island are indicated by asterisks. The name of each taxon is followed by a collection number which includes the site number (above) succeeded by a hyphen with an individual specimen number for the site. These are followed by boldface letters referring to the distribution pattern of Noble et al. (1987). Distributional subdivisions of a taxon present in more than one category are arranged alphabetically.

Alectoria nigricans*, 71-19, 71-40, 113-15, 246-8. **A.
A. ochroleuca, 246-26. Reported by Cummings (1910). **A.**

Allantoparmelia almquistii, 72-26, 202-7. Reported by Imshaug (1951). **W.**
Amandinea punctata*, 12-24, 14-26, 18-22, 31-21, 39-27, 39-28, 40-27, 50-22, 50-25, 68-26, 81-34, 88-34, 88-39, 90-26, 92-27, 107-22, 107-28, 122-29, 151-33. **C.
Amygdalaria elegantior*, 167-4. **A, B.
Bacidia alaskensis*, 166-9, 167-2. **C.
Biatora albohyalina*, 12-31. **U.
B. vernalis*, 81-47, 107-30. **I(w).
Bryocaulon divergens, 246-19. Reported by Cummings (1910) and Thomson (1984). **A, C.**
Bryoria chalybeiformis*, 65-X-2. **A, C, I(w).
B. nitidula*, 200-17. **A.
Buellia disciformis*, 3-27, 12-23, 68-27, 92-25, 97-28, 118-23, 122-31, 124-31. **C.
Caloplaca verruculifera*, 167-1. In Alaska this species is known from the Aleutian Islands, St. Paul Island, and northwestern Alaska, but apparently this is the first report from Kodiak Island (Arup 1994). **C.
Cavernularia lophyrea*, 124-30. **C.
Cetraria ericetorum*, 113-X-7. **C, I(d), I(w).
C. islandica, 71-17, 71-31A, 76-18. Reported by Cummings (1910) and Kärnefelt (1979). **A, I(d), I(w).**
C. laevigata*, 1-34, 98-41, 201-X-1, 246-28, 247-24. **A, B.
C. muricata*, 71-31B, 71-37, 98-37, 113-X-6, 144-24. **C.
Cladina arbuscula, 71-25, 76-10. Reported by Cummings (1910). **A, B, I(w).**
C. mitis, 1-29, 9-27, 71-23, 77-28, 144-17. Reported by Krog (1969) and Thomson (1984). **A, B, I(d), I(w).**
C. rangiferina, 1-39, 144-19, 247-14. Reported by Thomson (1984). **W.**
C. stellaris, 71-24. Reported by Cummings (1910) and Krog (1969). **A, B.**
C. stellaris* var. *aberrans*, 247-13 (P+ yellow). **A.
Cladonia amaurocraea*, 199-32, 202-X-1. **A, B, I(w).
C. bellidiflora, 24-X-12, 144-27. Reported by Thomson (1984). **A, C, I(w).**
C. carneola*, 247-35. **W.
C. coccifera*, 1-34C, 71-29, 144-23, 167-13, 169-19, 200-21, 215-14, 223-X-5. **W.
C. coniocraea, 12-36, 45-34, 92-28, 102-34. Reported by Degelius (1937) and Hedrick (1936). **B, I(w).**
C. cornuta, 58-X-1, 58-X-3, 65-X-4, 126-20, 223-X-1, 223-X-2, 223-X-4, 247-33A. Reported by Thomson (1984). **W.**
C. deformis, 223-X-3. Reported by Thomson (1984). **W.**
C. ecmocyna* subsp. *intermedia*, 58-X-4. Reported by Thomson (1984) as the species. **A, B, I(w).
C. fimbriata, 70-37, 194-11. Reported by Degelius (1937). **W.**
C. gracilis* subsp. *gracilis*, 1-34, 71-20, 71-25A, 73-32, 76-16, 77-23, 98-36, 113-X-7A, 144-19A, 144-20A, 201-X-3, 214-34, 215-11, 247-26. **A, B, W.
C. macroceras*, 76-23. **A.
C. maxima*, 1-34B, 98-37A. **C.
C. scabriuscula, 40-24. Reported by Degelius (1937) and Thomson (1984). **C, I(w).**
C. thomsonii*, 1-32, 144-18. **U.
C. uncialis*, 71-26, 247-18. **W.
Collema ceraniscum*, 168-X-5. **A.
C. nigrescens*, 60-27, 151-36. **C.
C. undulatum* var. *granulosum*, 37-31, 37-33. **C.
Flavocetraria cucullata*, 113-X-5. **A, B.
Hypogymnia enteromorpha, 124-27. Reported by Cummings (1910). **C, I(w).**

H. subobscura*, 66-X-2, 66-X-3, 66-X-7. **A.
Lecanora albella*, 18-21, 46-22, 50-21, 79-22, 79-29, 96-22, 96-23, 96-27, 118-25. **U.
L. circumborealis*, 12-22, 12-30, 45-27, 45-31, 60-26, 81-42, 124-29. **C, I(w).
L. impudens*, 81-33, 81-35, 81-35, 88-31. **B.
L. orae-frigidae*, 65-X-1. This is a westward range extension from Demarkation Point, Alaska, and northward from the Queen Charlotte Islands, British Columbia (Thomson 1997). **C.
L. polytropa*, 71-X-1 (with *Lecidea lapicida*), 200-23. **W.
L. pulicaris*, 12-36A, 53-22, 81-46, 102-27, 111-22. Thomson (1997) reports this as a far northwestern record. **B.
L. varia, 14-27, 50-28. Reported by Cummings (1910). **C.**
L. xylophila*, 57-X-1, 57-X-2, 66-X-1. **C.
Lecidea carnulenta, 39-23, 81-40, 102-28. J. W. Thomson (1997) reports this is probably a far northern record. **U.**
L. lapicida*, 71-X-1. **C.
L. praenubila*, 113-7. **U.
Lecidella stigmatea*, 100-11A, 113-9, 202-8, 242-14. **C.
Leptogium saturninum*, 37-22. **C, I(w).
Lobaria linita*, 1-20, 70-7, 214-30. **A, C.
Melanelia commixta, 113-3, 246-29. Reported by Cummings (1910). **A, I(w).**
M. hepatizon*, 100-13, 100-16. **W.
M. septentrionalis*, 37-26A, 81-36, 81-45, 102-33, 124-28, 124-33. **B, I(w).
M. stygia, 100-12. Reported by Cummings (1910). **A, I(d), I(w).**
Mycoblastus alpinus*, 81-41, 100-20, 102-31, 113-11. **A, C.
M. sanguinaris*, 182-35. **C, I(w).
Nephroma arcticum*, 247-9. **A, I(w).
Ochrolechia frigida*, 9-24, 72-18, 77-22A, 113-12, 113-16, 202-13, 202-X-2, 246-9, 246-29A. **A.
O. frigida* fo. *thelephoroides*, 77-25, 246-17. **U.
O. suplicans subsp. *hultenii*, 100-4, 200-20. Reported by Brodo (1988). **C.**
O. subplicans* subsp. *subplicans*, 77-32. **C.
Ophioparma lapponica*, 100-23, 246-5. **A, I(w).
Parmelia omphalodes, 100-3, 202-9. Reported by Cummings (1910), Krog (1969), and Thomson (1984). **I(w).**
P. saxatilis, 246-6, 246-20. Reported by Degelius (1937), Hedrich (1936), Krog (1969) and Thomson (1984). **W.**
P. sulcata, 12-32, 19-21, 37-27, 40-32, 45-26, 50-X-2, 65-X-3, 66-X-6, 81-48, 81-49, 88-X-3, 102-32, 124-26. Reported by Degelius (1937), Krog (1969) and Thomson (1984). **W.**
Peltigera aphthosa, 8-29, 126-17, 213-14. Reported by Cummings (1910), Degelius (1937), and Thomson (1984). **W.**
P. canina sens. lato., 88-X-4, 126-18, 172-17. Reported by Cummings (1910), Degelius (1937), and Thomson (1984). **A, B, I(d), I(w).**
P. collina, 14-23, 37-26, 46-23, 60-29, 79-23, 88-33, 88-4, 151-22, 151-39, 192-21. Reported by Thomson (1984). **C, I(w).**
P. didactyla*, 214-26. **W.
P. leucophlebia, 1-31. Reported by Thomson (1984). **W.**
P. malacea, 15-14, 191-24, 220-23. Reported by Hedrick (1936) and Thomson (1984). **W.**
P. membranacea, 1-26, 39-22, 39-29, 41-17, 46-10, 70-10, 79-30, 122-26, 147-21, 182-14, 204-17, 213-13, 226-18, 253-12, 254-24, 256-14, 258-23, 260-13, 262-10, 263-13. Reported by Thomson (1984). **C, I(w).**

P. scabrosa*, 247-32A. **A, B, I(d), I(w).
Pertusaria alpina*, 88-32. **B.
P. amara*, 107-23, 107-29. **C.
P. borealis*, 18-23, 39-26, 40-25, 45-30, 81-32, 102-30. **C.
P. bryontha*, 200-22. **U.
P. dactylina*, 77-22B, 144-25. **A.
P. panyrga*, 12-33, 71-21, 100-6, 100-10, 246-10. **A.
P. sommerfeltii*, 18-24, 90-29. **C.
P. subobducens*, 37-23, 215-16. **U.
P. suboculata*, 14-28, 53-23, 53-24, 79-21, 96-24, 97-22, 97-23, 97-25, 99-22, 111-23, 111-24, 118-24. **C.
Phaeophyscia hirtella*, 14-30. **C.
Physcia aipolia*, 37-29, 37-32, 79-28, 81-43, 88-35, 151-40. **C.
P. caesia*, 101-2, 167-3, 168-X-2. **W.
Platismatia lacunosa, 100-2, 167-6. Reported by Cummings (1910) and Krog (1969). **C.**
Porina lectissima*, 166-8. New to Alaska. **C.
Porpidia flavocaerulescens, 100-5, 113-1, 202-10, 246-3. Non-sorediate; syn. *P. flavicunda* (Ach.) Gowan. Reported by Gowan (1989) and Gowan & Ahti (1993). **U.**
Pseudephebe pubescens*, 72-15, 100-9, 113-6, 202-1A, 202-2, 215-17, 246-2. **A, I(d).
Psoroma hypnorum, 144-29. Reported by Thomson (1984). **A, C, I(d), I(w).**
Pyrenocollema halodytes*, 90A-1. **C.
Ramalina almquistii, 66-X-5. Reported by Krog (1969). **U.**
R. farinacea, 37-21, 81-38, 81-50, 88-X-1 (salazinic acid strain; soralia K+), 88-X-2 (acid deficient strain), 107-27, 151-21. Reported by Degelius (1937) and Hedrick (1936). **B, C, I(w).**
R. scoparia*, 168-X-1. **U.
Rhizocarpon anaperum*, 201-22, 201-23, 202-6. **U.
R. eupetraeoides*, 100-7, 100-11, 100-24, 113-5, 113-10, 202-3, 246-4. **A.
R. geminatum*, 101-3. **C.
R. geographicum*, 72-17, 113-18, 167-5, 202-15. **W.
Rinodina archaea*, 151-41. **C.
R. turfacea*, 9-25. **C.
Sphaerophorus fragilis, 100-8, 100-15, 202-5, 202-18. Reported by Hedrick (1936). **A.**
S. globosus, 71-16, 113-14, 144-21, 202-12, 246-13. Reported by Krog (1969) and Thomson (1984). **A.**
Stereocaulon alpinum, 1-28, 10-38, 70-35, 71-18, 76-11, 98-32, 214-23, 247-10. Reported by Cummings (1910). **A, I(w).**
S. arcticum, 201-X-2. **U.**
S. arenarium*, 113-2, 246-12. **A.
S. botryosum, 113-17. Reported by Thomson (1984). **A.**
S. paschale*, 77-20. **A, B, I(w).
S. rivulorum*, 144-20. **A.
S. saxatile*, 167-7. **A, B.
S. subcoralloides*, 100-21. **U.
Thamnolia subuliformis*, 71-31, 71-40A, 144-30, 247-23. **A.
T. vermicularis, 9-23, 246-15. Repored by Krog (1969). **A.**
Tremolecia atrata*, 202-4. **A.
Tuckermannopsis chlorophylla, 66-X-4. Reported by Degelius (1937) and Thomson (1984). **A, C, I(w).**
Umbilicaria angulata*, 113-20, 167-8. **A, C, I(w).

U. arctica, 72-17. Reported by Thomson (1984). **A.**
U. lyngei*, 100-1, 202-1, 246-1. **A.
U. proboscidea, 113-4. Reported by Krog (1969) and Thomson (1984). **A.**
Verrucaria maura*, 101-X-1. **C.
Xanthoria candelaria, 151-35. Reported by Degelius (1937), Krog (1969), and Thomson (1984). **C, I(d), I(w).**
X. elegans, 101-1, 130-1. Reported by Thomson (1984). **W.**

Lichen components of the vegetation

Numerical-phytosociological analyses of the 266 vegetation plots identified 31 relevé-groups, or community types. Of these, eleven community types -- nine epigeaic and two epilithic -- contained lichen taxa that occurred in more than one relevé and only four contained a prominent lichen component (Tables 2 and 3). With the exception of these four community types, most of the lichens within the study area are relatively infrequent, not abundant, and occur scattered over the landscape.

Community-types richest in epigaeic lichens peaked in upper mountain slope habitats, particularly on *Empetrum nigrum-Oxytropis nigrescens* heaths (No. 1) of north-facing slopes (Table 1). Characteristic macrolichens with a presence of 60% or higher in these north-facing habitats included *Cladonia gracilis*, *C. coccifera*, *Cladina mitis*, *C. rangiferina*, *C. stellaris*, *Lobaria linita*, *Sphaerophorus globosus*, *Stereocaulon alpinum*, and *Thamnolia subuliformis*, while on south-facing upper slopes in the *Empetrum nigrum-Festuca altaica* heath (No. 2), only *Stereocaulon alpinum*, peaked in abundance. Lichens occurring over a wide range of upper to lower slope community types (Nos. 1-9) were from the genus *Peltigera* (*P. membranacea*, *P. aphthosa*, and *P. malacea*). *Peltigera membranacea* was the most widely distributed species.

Community types 1 and 2 of upper mountain slopes occur at mean elevations of 532 and 432 m; the soils of these communities have the thinnest A horizons (3.3 and 6.5 cm) and ash deposit layers (2.3 and 4.8 cm) of all communities. All other epigeaic communities range in mean elevation from 22 to 391 m, A horizon depths from 5.4 to 11.5 cm, and ash deposit layer depths from 9.8 to 14.5 cm. These data indicate that lichen species diversity is lowest in the low elevation community types 3 to 9, where ash deposit and A horizon layers are the thickest, and highest in the high elevation community types, where they are the thinnest.

The epigeaic lichen component of community types 12 through 31 was either absent or nearly absent; the names of these types are given in Table 4.

Two communities of epilithic lichens were identified: *Xanthoria elegans-Rhizocarpon geminatum* escarpment (No. 10) and *Pseudephebe pubescens-Rhizocarpon eupetraeoides* rock outcrop (No. 11)(Table 3). The first (No. 10) occurs on low-elevation coastal escarpments; the two primary species of this type are listed in the name. The second (No. 11) typically occurs along high elevation ridge tops on tors; common species include *Lecidella stigmatea, Porpidia flavicaerulescens, Pseudephebe pubescens, Rhizocarpon eupetraeoides*, *Sphaerophorus globosus,* and *Umbilicaria lyngei.*

The relationship of epiphytic lichens to their woody hosts are shown in Table 5. Two species, *Amandinea punctata* and *Ramalina farinacea*, occurred on all four hosts. Presence of some epiphytic lichens peaked on particular woody species. Thus, lichens with a presence >40% on only one or two hosts were *Amandinea punctata* on *Alnus crispa* and *Populus trichocarpa*; *Buellia disciformis* and *Pertusaria suboculata* on *Alnus crispa*; *Cladonia coniocraea*, *Lecanora circumborealis*, *L. pulicaris*, *Melanelia septentrionalis*, *Parmelia sulcata*, and *Pertusaria borealis* on *Betula kenaica*; *Peltigera collina* on *Salix* spp. and *Populus trichocarpa*; and *Collema nigrescens*, *Pertusaria sommerfeltii*, and *Physicia aipolia* on *Populus trichocarpa*.

TABLE 2. Synoptic table of macrolichens in epigeaic community types in western Kodiak Island, Alaska. Only lichens occurring in more than one relevé are shown. The first figure in a column indicates presence class, the second gives the mean cover class when the species is present (see Methods). Community types: 1, *Empetrum nigrum-Oxytropis nigrescens* heath; 2, *Emptrum nigrum-Festuca altaica* heath; 3, *Deschampsia beringensis-Equisetum arvense* meadow; 4, *Calamagrostis canadensis-Angelica genuflexa* meadow; 5, *Sanguisorba-stipulata Epilobium angustifolium* meadow; 6, *Angelica lucida-Carex macrochaeta* meadow; 7, *Alnus crispa-Dryopteris austriaca* thicket, 8, *Calamagrostis canadensis-Urtica dioica* meadow; and 9, *Betula kenaica-Calamagrostis canadensis* meadow.

Community type	1	2	3	4	5	6	7	8	9
Number of relevès	9	14	10	12	16	17	28	13	11
Mean elevation (m)	1747	1419	330	463	857	1284	857	277	72
Mean ash depth (cm)	2.3	4.8	11.9	11.5	14.5	14.5	14.5	11.6	9.8
North-facing upper mountain slopes									
Sphaerophorus globosus	IV 2	.	.	.	.	.	.	.	.
Thamnolia subuliformis	III 2	.	.	.	.	.	.	.	.
Cladina stellaris	III 2	.	.	.	.	.	.	.	.
C. arbuscula	II 2	.	.	.	.	.	.	.	.
Cladonia uncialis	II 2	.	.	.	.	.	.	.	.
C. subfurcata	II 2	.	.	.	.	.	.	.	.
Cetraria islandica	II 2	.	.	.	.	.	.	.	.
C. muricata	II 2	.	.	.	.	.	.	.	.
Pseudephebe pubescens	II 3	.	.	.	.	.	.	.	.
Umbilicaria arctica	II 3	.	.	.	.	.	.	.	.
North- and south-facing upper mountain slopes									
Stereocaulon alpinum	III 2	III 2	.	.	.	.	.	.	.
Cladina rangiferina	III 3	II 2	.	.	.	.	.	.	.
C. mitis	III 4	+ 2	.	.	.	.	.	.	.
Cladonia gracilis	IV 3	I 2	.	.	.	.	.	.	.
C. coccifera	III 2	+ 2	.	.	.	.	.	.	.
Lobaria linita	III 2	II 3	.	.	.	.	.	.	.
Cetraria laevigata	II 2	+ 1	.	.	.	.	.	.	.
Widespread, upper to lower mountain slopes									
Peltigera membranacea	.	II 2	II 2	I 1	I 1	I 1	r 1	.	+ 1
P. aphthosa	II 2	II 1	.	.	II 2	.	.	.	+ 1
P. malacea	.	.	.	.	II 2	.	.	+ 1	.

TABLE 3. Synoptic table of community types in western Kodiak Island, Alaska, with distribution of epilithic lichens within types. Only lichens occurring in more than one relevé are shown. The first figure in the column indicates presence class, the second gives the mean cover class when the species is present (see Methods). Community types: No. 10. *Xanthoria elegans-Rhizocarpon geminatum* escarpment, and No. 11. *Pseudephebe pubescens-Rhizocarpon eupetraeoides* rock outcrop.

Community type	10	11
Number of relevés	2	4
Mean elevation (m)	3	597
Xanthoria elegans	V 7	.
Rhizocarpon geminatum	V 4	.
Pseudephebe pubescens	.	V 4
Rhizocarpon eupetraeoides	.	V 5
Lecidella stigmatea	.	V 4
Porpidia flavocaerulescens	.	V 3
Umbilicaria lyngei	.	IV 5
Sphaerophorus globosus	.	IV 2
Melanelia commixta	.	III 3
Parmelia omphalodes	.	III 4
Stereocaulon arenarium	.	III 2
Ophioparma lapponica	.	III 2
Pertusaria panyrga	.	III 2
Mycoblastus alpinus	.	III 2
Alectoria nigricans	.	III 2
Ochrolechia frigida	.	III 2

Discussion

Low representation of the dry interior ecological-geographic elements coupled with the high percentages of coastal and wet interior taxa in the floras of Tuxedni Wilderness Area and western Kodiak Island indicate that these elements extend northwestward from British Columbia to as far as Kodiak Island (Table 1). Thus, the maritime climate of western Kodiak Island and Tuxedni Wildersness Area is reflected in the lichen flora. The higher percentages of alpine-subalpine and boreal elements in their floras compared with British Columbia presumably reflects their more northern geographical location.

Compared to the lichen floras from other areas in western Alaska (Thomson & Sowl 1989; Talbot et al. 1991, 1992, 1997) where the total lichen floras ranged from 149 to 219 taxa, the total number of lichen taxa, 129 taxa, of the Chief Cove area is lower. Areally this comparison is valid only for Tuxedni Wilderness with 218 taxa (Talbot et al. 1992). Low species diversity in the Spiridon Peninsula may be a reflection of variation in sampling intensity. Effective lichen collecting time spent in the Spiridon Peninsula was about 40% less than in the other studies of Talbot et al. above.

TABLE 4. List of plant community types where an epigeaic lichen component is either absent or nearly absent. The number of releves comprising the type is shown in parentheses.

No.	Community type
12	*Populus trichocarpa-Athyrium filix femina* forest (8)
13	*Salix glauca-Athyrium filix-femina* thicket (8)
14	*Salix pulchra/S. barclayi-Lycopodium annotinum* thicket (8)
15	*Sambucus racemosa-Claytonia sibirica* thicket (4)
16	*Rubus spectabilis-Calamagrostis canadensis* thicket (7)
17	*Vaccinium uliginosum-Empetrum nigrum* mire (3)
18	*Epilobium angustfolium-Lathyrus palustris* meadow (21)
19	*Epilobium angustifolium-Calamagrostis canadensis* meadow (16)
20	*Leymus mollis-Ligusticum scoticum* beach meadow (8)
21	*Senecio pseudoarnica-Leymus mollis* beach meadow (5)
22	*Lysichiton americanum-Claytonia sibirica* wet meadow (4)
23	*Equisetum arvense-Mimulus guttatus* wet meadow (5)
24	*Carex aquatilis/C. saxatilis* graminoid marsh (3)
25	*Equisetum fluviatile-Menyanthes trifoliata* forb marsh (2)
26	*Heuchera glabra-Campanula lasiocarpa* meadow (2)
27	*Potamogeton alpinum-Ranunculus trichophyllus* aquatic marsh (3)
28	*Nuphar polysepalum* aquatic marsh (3)
29	*Potentilla egedii-Stellaria humifusa* beach meadow (7)
30	*Puccinellia nutkaensis-Plantago maritima* beach meadow (3)
31	*Zostera maritima* seagrass meadow (2)

Thick ash deposition, 30 cm, from the eruption of Mt. Katmai in 1913 may have had a marked effect on lichen diversity. In reconstructing the effects of the 1907 eruption of Ksudach volcano on the Kamchatka Peninsula, Grishin et al. (1996) showed that secondary succession dominated in ash deposits of 10 to 30 cm; they also showed that deposits of 10 to 20 cm eliminated lichens and mosses and but only reduced the number of dwarf shrubs and herbs. The thinnest ash deposits and the lushest lichens in the Chief Cove area were on upper mountain slopes. Assuming that 30 cm of ash was originally deposited evenly over the study area, presumably the ash deposits in the upper mountain areas were redistributed by wind and colluvial action to lower slopes resulting in thinner ash layers at higher elevation. Some of the lichen taxa present before the Katmai eruption may have survived in these alpine sites.

Lichen diversity and abundance may also be reduced by the lush growth of the vascular plants in the study area, shading lichens and blanketing them in litter. The relatively deep A soil horizon formed over the 86 years since the eruption of Katmai volcano suggests that litter accumulation in the area is significant.

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TABLE 5. Occurrence of epiphytic lichens on four woody shrub and tree taxa in western Kodiak Island, Alaska. Lichen taxa are listed alphabetically. Key to host taxa: 1, *Alnus crispa*; 2, *Betula kenaica*; 3, *Salix* spp. (*Salix pulchra*, S. *glauca*, and *S. alaxensis*); and 4, *Populus trichocarpa*. Presence class: +, <10%; I, 10.1-20%; II, 20.1-40%; III, 40.1-60%; IV, 60.1-80%; 80.1-100%. Only lichens occurring in more than one relevé are shown.

Woody vascular taxa	1	2	3	4
Number of relevés	14	6	5	3
Amandinea punctata	III	II	II	IV
Biatora albohyalina	.	I	I	.
Buellia disciformis	III	II	I	.
Cladonia coniocraea	+	III	.	.
Collema nigrescens	.	.	.	IV
Lecanora albella	II	II	II	.
L. circumborealis	.	III	.	II
L. impudens	.	I	.	II
L. pulicaris	I	III	.	.
L. varia	II	II	.	.
Lecidea carnulenta	.	II	I	.
Melanelia septentrionalis	.	III	I	.
Mycoblastus alpinus	.	II	.	.
Parmelia sulcata	.	V	II	.
Peltigera collina	+	.	III	V
P. membranacea	+	.	II	.
Pertusaria suboculata	III	.	.	II
P. borealis	+	IV	I	.
P. sommerfeltii	.	I	.	.
Physcia aipolia	.	.	II	IV
Ramalina farinacea	+	I	I	II
Rinodina archaea	.	.	I	II

spanned vast distances from Attu Island of the Alaska Maritime National Wildlife Refuge (NWR) in the westernmost Aleutian Islands to Tetlin NWR in eastern Alaska; and from the Arctic NWR in the north to the Kenai NWR in the south central Alaska. The contribution to knowledge of the Alaskan lichen flora provided by John Thomson is unparalleled and unprecedented. We are all the richer for it.

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