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Lichenometric Distribution of *Rhizocarpon geographicum* on Mt. Washington: A Relative Dating Tool.

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the opening of the Carriage road had upon the whole tourist industry in the White Mountains. □

Footnotes:

(1) Significantly, perhaps, the enterprising Eastman was also financially involved with this famous hotel. The line he mentions likely came in from Littleton, where the White Mountain Railroad terminated.

(2) The open steel shell is the main difference between the Mount Washington rams horn and others. The glass which fills the insulator is found in several colors indicating that the insulators were made from whatever glass remained at the end of the day in nineteenth century glass factories.

(3) Apparently, everyone had a commission in those days.

(4) The first road company went bankrupt in 1857. The second, the Mount Washington Summit Road Company, that which continues to exist today, was, as we all know, successful.

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Lichenometric Distribution of *Rhizocarpon geographicum* on Mount Washington: A Relative Dating Tool

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The Mount Washington area provides a classic setting for studies of glacial and periglacial environments. The glacial environment which dominated this region as recently as 12,000 y. B.P.[1] left evidence of its presence in the form of glacio-depositional and erosional features. Patterned ground features characteristic of the periglacial environment that followed ice recession in the Mount Washington area are found at elevations above 4,200 feet and are still actively forming at elevations above 5,800 feet.[2] An appreciation of the changes in climate from glacial to periglacial and the transition from periglacial to temperate currently affecting Mount Washington relies heavily upon dating of the features characterizing these events. Lichenometry can provide the means to both relative and absolute dating of features as demonstrated in areas such as Greenland,[3] the Colorado Front Range,[4] and the San Juan Mountains.[5] Our lichenometric survey on Mount Washington includes 93 sites which we use to define the regional trend in lichen growth rate and hence develop a framework for the dating of features in this area.

Rhizocarpon geographicum (L.) D.C. was chosen as the main study lichen for the Mount Washington survey because it commonly occurs above treeline and in otherwise exposed areas. In addition several growth curves have been published for this species. A first approximation *R. geographicum* growth curve (Figure 1) was developed for this study using measurements at two dated localities in conjunction with published growth curves for environments similar to that found on Mount Washington. The two dated localities are the foundation stones at Tip Top House (AD 1853) and Lake of the Clouds Hut (AD 1915-1922). The foundation stones were cut prior to their emplacement and, therefore, were lichen-free at the time of construction. The pre-AD1853 portion of the Mount Washington *R. geographicum* growth curve was es-

timated from growth curves determined in Alberta, Canada[6] and the Colorado Front Range.[4] The dated portion of the Mount Washington growth curve falls between these two curves. Assuming that older portions of the Mount Washington curve also remain between these two curves the largest *R. geographicum* thalli (10 cm) found during the study has been growing for approximately 1,050 to 2,650 years. This implies that the rock surfaces upon which the largest thalli are found have been subaerially exposed and have not rolled over for this time period.

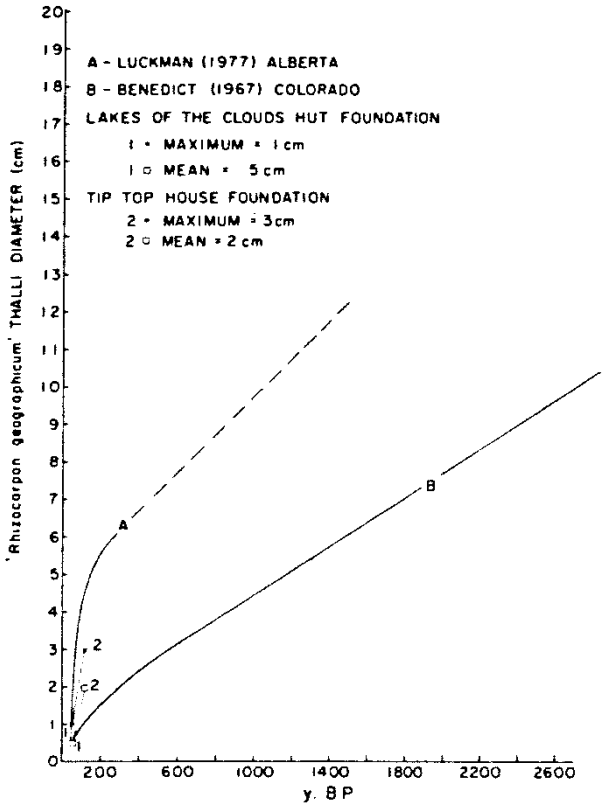

Figure 1. Mount Washington Lichen growth curve.

For each of the 93 sites (Figure 2) investigated in the lichenometric survey, the following measurements were made: elevation, site exposure and description, rock type, clast size if site comprised of unconsolidated rock, total lichen cover, percent cover of *R. geographicum* and the 10 largest *R. geographicum* thalli diameters in the immediate area. Almost all site elevations were above treeline in the range 3,450-6,288 feet asl. Site exposures examined included all eight points of the compass. Site locations were made primarily on bedrock outcrops such as tors, although some observations were also made on patterned ground features. All lichen thalli measured were found exposed on the quartzite, and hists of the Littleton Formation. No clear trends in mineral association as a function of lichen cover or thalli size were observed. Measurements of clast size for sites on unconsolidated rock revealed a fairly direct relationship between lichen thalli size and clast size. Except at several isolated localities total lichen cover including *R. geographicum* and several other species was close to 100%. Percent total cover of *R. geographicum* remained fairly constant at all sites in the range 30-40%.

At each site studied the 10 largest *R. geographicum* diameters were measured. Only individual thalli that were circular (Figure 3) or nearly circular were used and no measurements were made on lichen growing on the corners of rocks. The mean diameters of the 10 *R. geographicum* measured at each site, with standard deviations to the nearest .5 cm, plotted as a function of elevation and orientation (Figure 4), display the general trend for the area surveyed. This trend can be broken into several elements. North-facing study sites tend to be locales for concentrations of the larger *R. geographicum* thalli (5-6.5 cm). Regardless of exposure, standard deviations about the mean of each set of 10 measurements increases as the mean increases except for the larger thalli sizes on the north-facing slopes. Measurements of lichen on north-facing slopes have standard deviations closer to measurements on lichen 2-3 cm smaller found on other slopes. The large lichen thalli and small standard

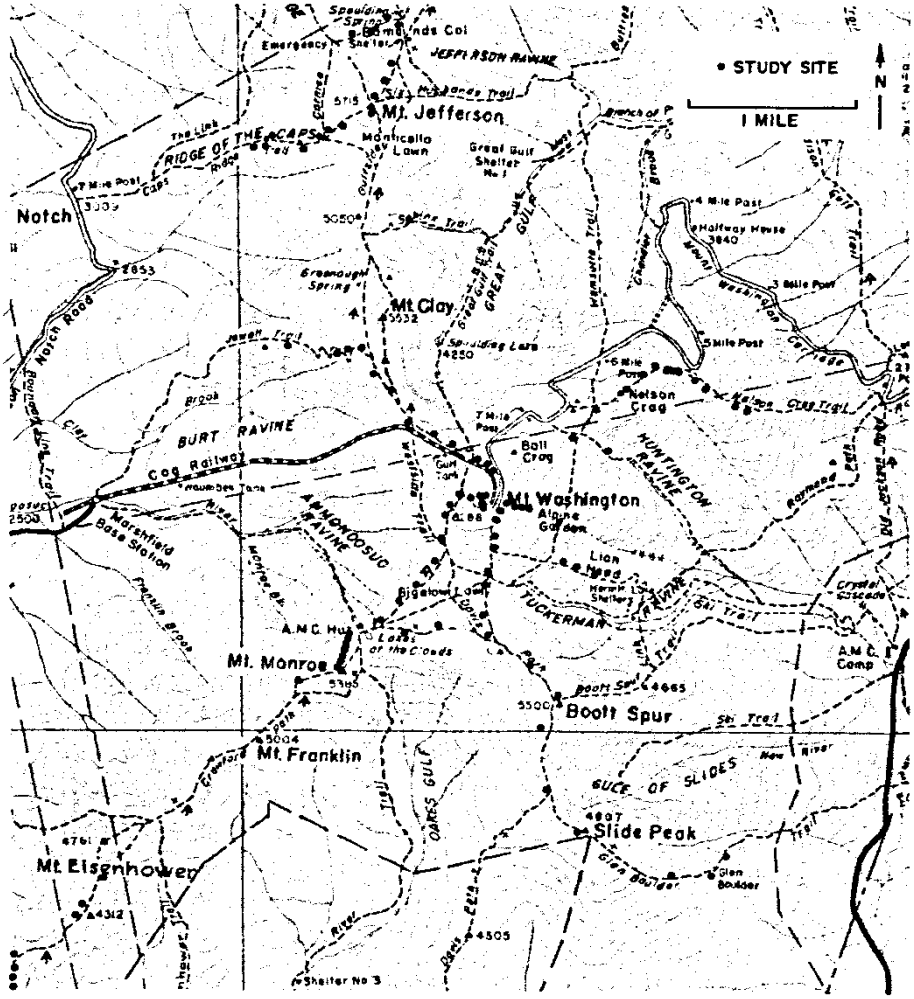

Figure 2. Lichenometric survey sites plotted on the *1973 AMC Map of the Mount Washington Range.*

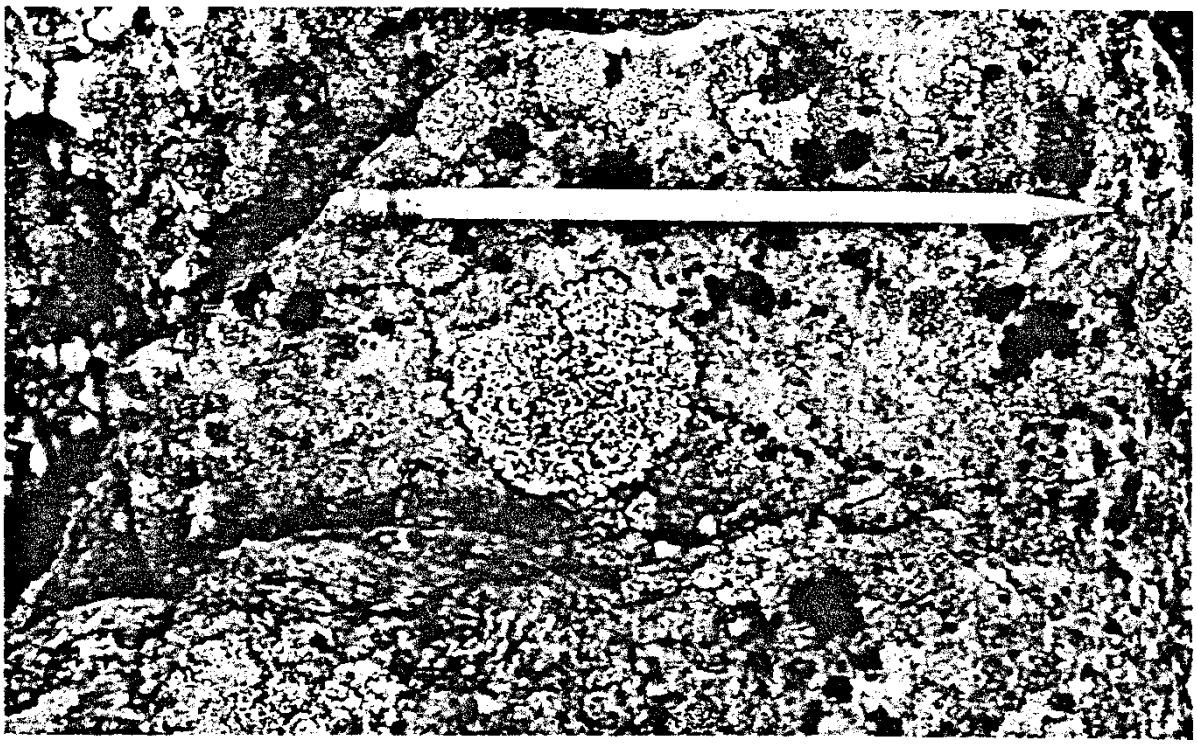

Figure 3. *Rhizocarpon geographicum*, Mount Washington.

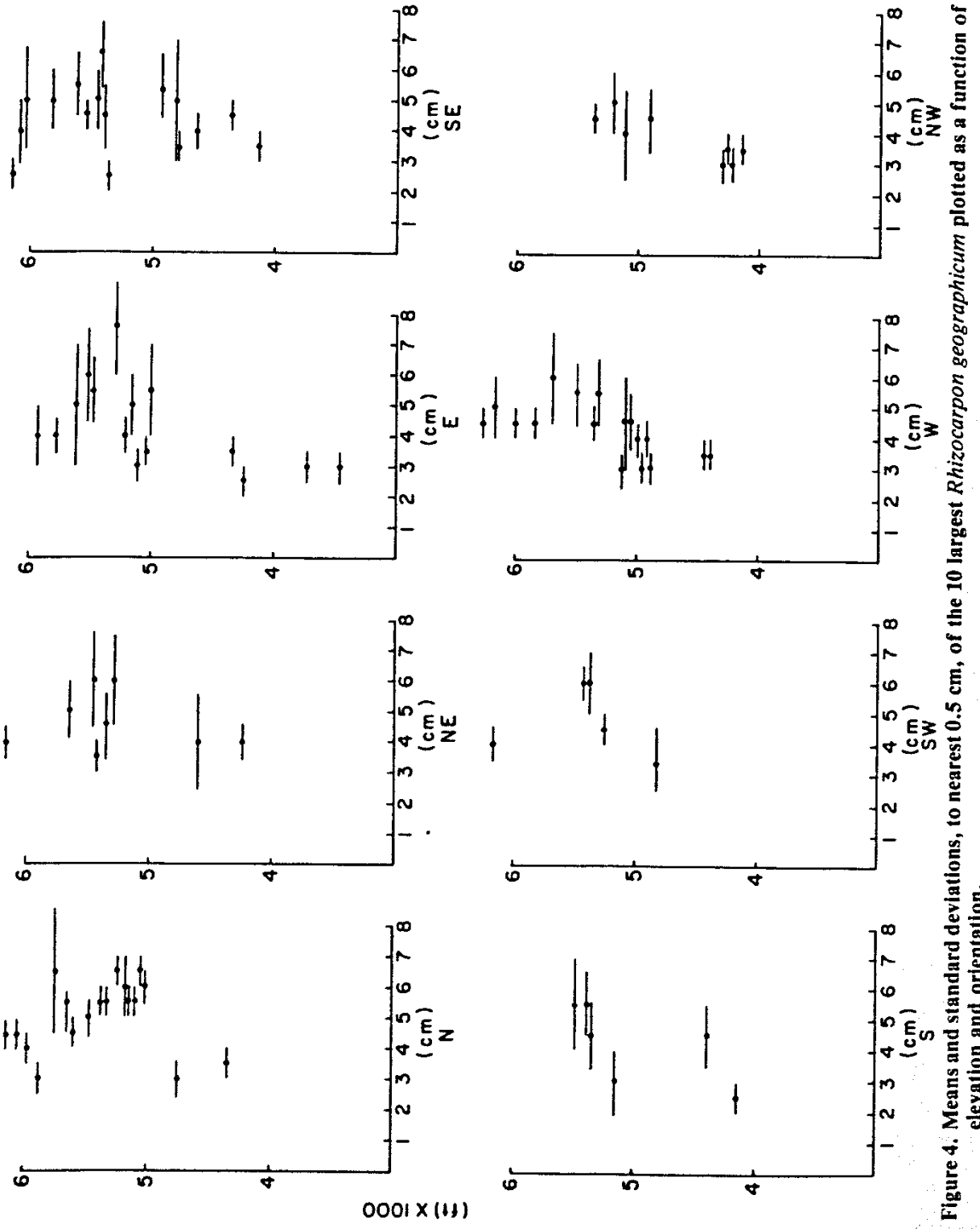

Figure 4. Means and standard deviations, to nearest 0.5 cm, of the 10 largest *Rhizocarpon geographicum* plotted as a function of elevation and orientation.

deviations measured on the north-facing slopes may suggest that the lichen growth conditions on these slopes are relatively uniform. Thus, if any regional trend is to be identified, north-facing slopes should provide optimum conditions for maintenance of such a trend. The most noticeable trend on these slopes is the general increase in *R. geographicum* thalli size at sites between 5,000-5,750 feet asl. Although slightly more obscured, all other orientations display an increase in thalli size within this elevation range. Thus, mean thalli size varies as a function of elevation, but not directly. No unique explanation is apparent for this trend. However, several possibilities exist: (1) *R. geographicum* thalli vary as a function of the differences in climate induced by elevation (he has identified variations in water balance as a function of elevation for this region),[7] (2) 5,000-5,750 feet is the optimum elevation at which *R. geographicum* grows in this area, (3) elevations above 5,750 feet have been snow-covered year round or actively cryoturbated for some portion of the total lichen growing period and thus relatively little growth has occured above this elevation, (4) any combination of the foregoing. Having identified the fact that a lichenometric trend does exist, local departures from this trend can be used to signal the relative age of climatic and environmental events in the Mount Washington area.

Local departures from the regional trend in the mean diameter of *R. geographicum* as a function of elevation and orientation were identified at several localities during the study survey. The examples which follow serve to demonstrate the applicability of lichenometry on Mount Washington. Anomalously large means and standard deviations (Figure 4) of the lichen thalli measured at 5,750 feet, north-facing slope, and 5,300 feet, east-facing slope, are believed to be associated with the location of these lichen along the marginal portions of the longer-lasting snowpatches in the study area. The ready availability of moisture provided to the lichen by this sort of location apparently increases their growth rate. Anomalously small means of the thalli (Figure 4) at 5,375 feet, southeast-facing slope, and 5,420 feet, northeast-facing slope, were found on patterned ground stripes. The existence of the smaller size thalli at these elevations suggests that cryoturbation activity was intense enough to disrupt lichen growth during some portion of the total available growing period estimated from the Mount Washington growth curve.

In addition to marking the distribution of snowpatches and the relative age of patterned ground features, local departures from the regional lichenometric trend may also be used to define and relatively date: changes in the distribution of soils and vegetation, avalanche deposits, and abrasion of hiking trails. Lichenometric studies will be undertaken in the following year to date more precisely features and events on Mount Washington. □

Footnotes:

(1) Goldthwait, R. P., 1970, "Mountain Glaciers of the Presidential Range in New Hampshire," *Arctic and Alpine Research*, v. 2, No. 2, pp. 85-102.

(2) Goldthwait, R. P., 1968, "Guide - to a day and a half in the White Mountains and on top of Mount Washington, NH, International Symposium on Antarctic Glaciological Exploration, Dartmouth College, 14 p.

(3) Beschel, R. E., 1961, Dating Rock Surfaces by Lichen Growth and Its Application to Glaciology and Physiography (lichenometry)," G.O. Raash, ed., *Geology of the Arctic*, v. 2, University of Toronto Press, pp. 1044-1062.

(4) Benedict, J. B., 1967, "Recent Glacial History of an Alpine Area in the Colorado Front Range, U.S.A. I. Establishing a Lichen Growth Curve," *Journal Glaciology*, v. 6, No. 48, pp. 817-831.

(5) Carrara, P. E., and Andrews, J. T., 1973, Problems and Applications of Lichenometry to Geomorphic Studies, San Juan Mountains, Colorado," *Arctic and Alpine Research*, v. 5, No. 4, pp. 373-384.
(6) Luckman, B. H., 1977, Lichenometric Dating of Holocene Moraines at Mount Edith Cavell, Jasper, Alberta," *Canadian Journal Earth Sciences*, v. 14, pp. 1809-1822.
(7) Dingman, S. L., 1978, "Water Balance as a Function of Elevation in New Hampshire and Vermont [abstr.]," *EOS*, v. 59, No. 4, p. 273.

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Mount Washington Gets Dial Telephones

Alexander McKenzie

After 46 years of dependence on operator assistance, observers at New England's highest peak can now dial directly any telephone in the North American switched telephone network. And anyone can now call the Mount Washington Observatory from his own telephone without going through an operator.

For the past 17 years, New England Telephone has maintained a radio circuit between the Observatory and Littleton. Outgoing calls from the summit were received by a Littleton operator and routed into the dial network. Although local operators in towns near the Mountain easily handled calls to 466-0001, which was commonly abbreviated to "Gorham 01," callers from a distance often had difficulty. If they dialed the number they reached an intercept operator or recording telling them to dial their local operator who would handle the call. Generally, the local operators were somewhat confused by the need to go through Littleton for a Gorham number! Sometimes, people gave up. Now, it may be too easy to call. The mountain staff, whose duties are arduous, and who must make frequent observations, hope that not too many people will dial them with frivolous requests.

The new microwave system that was put into operation on September 15, has a capacity at present for six telephone lines. There are plans to install more lines next spring. Besides the Observatory, the telephone company must serve the State, a pay telephone or two, civil defense, construction operations, and others.

The microwave link, operating at a frequency of about two gigahertz, replaces older equipment that used a frequency of 459 megahertz, about a quarter the frequency of the new. Although the former transmitter-receiver gear was housed in the Observatory, the new station has been set up in the so-called Yankee Network building where there is more room. All six lines are combined, or multiplexed, on a single radio channel. After being received at Littleton, the six-line signal is put on a wired-radio or carrier circuit to Gorham. There, the signals are se-