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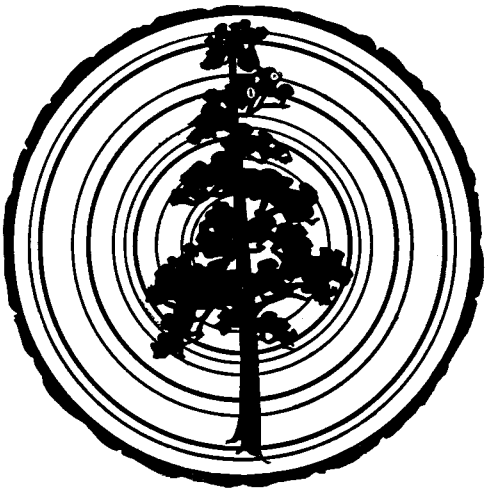

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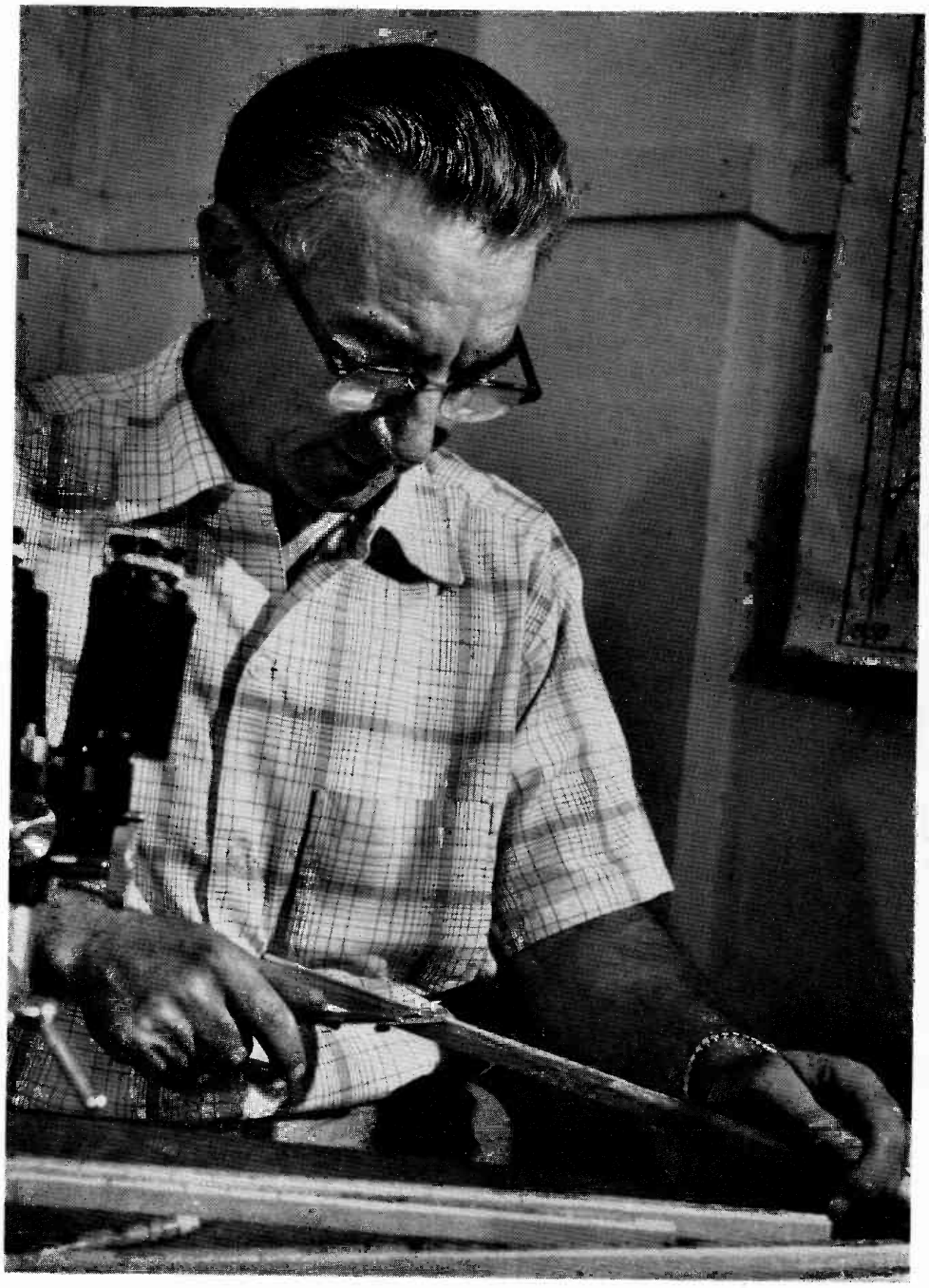

EDMUND SCHULMAN 1908-1958

Edmund Schulman, associate professor of dendrochronology and managing editor of the Tree-Ring Bulletin, was stricken with a fatal heart attack on the University of Arizona campus, January 8, 1958. On the day of his death he was actively engaged, with characteristic energy and devotion, in matters of research. Although only forty-nine years of age, Edmund had established himself as an outstanding figure in his chosen field, and the deep sense of personal loss felt at his passing is compounded by the realization that perhaps his most definitive scientific contributions were yet to be made.

Edmund Schulman was born July 19, 1908 in Brooklyn, New York. He received his early schooling there and later attended New York University and Brooklyn College during the years 1927-1930. Following a year spent at Arizona State Teachers College at Flagstaff, Arizona, he came to the University of Arizona in 1932. As an assistant to Dr. A. E. Douglass, he received his first contact with dendrochronology and aided in the development of the methods of tree-ring analysis. He was named assistant astronomer at the University's Steward Observatory in 1933 and earned the Bachelor of Science degree that year. Continuing his studies at the University of Arizona, he earned the Master of Science degree in 1935. He was encouraged to pursue his major interest in dendroclimatic work by the award of a continuing fellowship from the Carnegie Institution of Washington through the years 1934 to 1937.

A desire to broaden his academic background and to improve his effectiveness as a research scholar prompted him to enroll at Harvard University for graduate work, and he received the Master of Arts degree there in 1938. He was appointed a fellow in Harvard's Blue Hill Observatory for the years 1938 and 1939. His publications during that period indicate his strong interest in astronomy, mathematics, statistics, and cycle analysis, an interest which was to have a profound effect upon his researches in later years.

In 1939, Edmund returned to the University of Arizona where he was appointed Instructor in Dendrochronology and Assistant in the Laboratory of Tree-Ring Research. It was at this time that he became managing editor of the Tree-Ring Bulletin and an officer in the Tree-Ring Society. He was named Dendrochronologist in the Laboratory of Tree-Ring Research in 1941, the title he retained until his death. He returned to Harvard University in 1942, and, after serving as a Harvard Fellow for two years, the Doctor of Philosophy degree (in climatology) was conferred upon him in 1944. Returning to the University of Arizona, he was appointed Assistant Professor in 1945 and Associate Professor in 1947. During the years 1953-1954, Edmund was invited to serve as a Visiting Professor of Dendrochronology at the California Institute of Technology, Pasadena.

Indicative of Edmund's character was the high esteem in which he was held by his scientific colleagues throughout this country and abroad. The grants he received for his climatological studies reflect his eminent position as a research scientist and his membership in scientific societies such as the American Astronomical Society, the American Geophysical Union, the American Association for the Advancement of Science, the

American Meteorological Society, the Society of the Sigma Xi, the American Geographical Society, and the Tree-Ring Society attest both to his varied interests and to his professional standing.

Edmund's contributions to the science of dendrochronology are known to all students of tree-ring analysis. The results of his studies appeared in many professional journals and his monographic studies on the dendroclimatology of semiarid America will stand as basic contributions. His influence on the development of tree-ring analysis, through work by himself and in conjunction with Douglass, has been of importance in shaping the methodology used today in tree-ring work. The inspiration derived from his pioneering efforts in dendroclimatology will undoubtedly influence the course of much of the future research in this field.

Many of his contributions are so basic and fundamental that it is impossible to attempt to single out a particular one, yet his outstandingly successful search of western North America for long-lived trees containing "sensitive" and "faithful" tree-ring records must be mentioned. His search, while producing long, homogeneous records for many parts of the west, culminated in the spectacular discovery of the age of the bristlecone pine of east-central California, several of which contain more than 4500 annual rings, and hence are shown to be the world's oldest known living things. These discoveries brought considerable distinction to Edmund and to the University of Arizona.

Throughout his professional life Edmund Schulman was characterized by extraordinary devotion to his work. His writings show remarkable attention to detail and his insistence upon accuracy and precision was reflected in all phases of his research. Justly, his reputation as a scientist extended far beyond the limits of his own speciality. The pages of this Bulletin over the last two decades might well stand as a fitting tribute to his productive, but tragically interrupted, career.

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DENDROCHRONOLOGICAL STUDIES IN NEW ZEALAND

VIRGINIA and ROBERT E. BELL

Introduction

J. Golson (1955) has pointed out the possibilities of applying tree-ring dating to the solution of problems in New Zealand chronology. Several factors suggest that this method may be especially fruitful: 1) the time span of New Zealand prehistory is relatively short and is sufficiently recent so that master charts of only 200 to 300 years would be useful in dating archaeological materials, 2) there is an abundance of well preserved wooden artifacts available in the museum collections, and, 3) there should be adequate samples of old living trees within forest reserves or unsettled areas for the preparation of a master chart.

In the Spring of 1955, the Wenner Gren Foundation for Anthropological Research granted financial aid to the senior author to investigate the possibilities of applying dendrochronological methods in New Zealand. The research work was carried out in the period from August, 1955 to May, 1956. During this time a number of persons contributed time and information to the project. Acknowledgment is especially due to Messrs. Vic Fisher, Auckland Institute and Museum at Auckland; Roger Duff, Canterbury Museum at Christchurch; and Leslie Lockerbie, Otago Museum at Dunedin. Interviews and consultations were conducted with numerous botanists and foresters in an effort to secure background data and information on current research. Among those consulted were the directors and staff members of the New Zealand Forest Products Laboratories at Auckland, the New Zealand Forest Service at Wellington, and the Forest Research Institute at Rotorua.

A survey of the literature published in New Zealand indicates the paucity of research in dendrochronology. Lockerbie (1950) presented an estimated minimum age for some middens in Otago on the basis of average tree growth rate measurements. Oliver, at an earlier date (1931), suggested an age of more than 500 years for a Maori oven on the basis of an estimated growth rate of a large totara. Batley (1956) has studied scars on a number of mutilated trunks of totara to determine the date of bark removal. The Maori used tree bark for a number of purposes and many such mutilated trees are still growing. By ring counts of wood formed after bark removal, Batley has been able to estimate the approximate date for the scar.

Systematic tree-ring studies are beginning in this area, but most basic research concerned with tree growth and the various factors which influence tree growth have been neglected. Information which would be useful in dendrochronology, such as studies of annual rings, the formation and cause of false rings, duration of growing seasons, effects of rainfall, temperature, and runoff upon growth, is not available. The studies that have been made are limited, being chiefly confined to the "exotic" timbers imported from North America. Consequently, studies of the native New Zealand timbers remain a matter for the future. This deficiency in available botanical information has been a handicap to exploratory dendrochronological studies.

New Zealand Trees

Initial studies constituted an examination of a number of New Zealand timbers to see what species appeared to be most useful for tree-ring analysis. The following species were examined:

Agathis australis	Kauri
Beilschmiedia tawa	Tawa
Corynocarpus laevigata	Karaka
Dacrydium cupressinum	Rimu
Elaeocarpus dentalus	Hinau
Knightia excelsa	Rewa Rewa
Laurelia novea-zelandiae	Pukatea
Litsea calicaris	Mangeao
Metrosideros robusta	Rata
Nothofagus menziesii	Tawhai
Olea cunninghamii	Maire
Paratrophis microphylla	Towai
Podocarpus dacrydioides	Kahikatea
Podocarpus ferrugineus	Miro
Podocarpus hallii	Totara (Hall's)
Podocarpus spicatus	Matai
Podocarpus totara	Totara

Of this group, the kauri *(Agathis australis)* and totara *(Podocarpus halli* and *P. totara)* appeared to offer the best possibilities. These were selected for several reasons: 1) the ring records are relatively clear, 2) the trees have a long life span so that it is possible to obtain lengthy ring records, 3) growing stands of these species are available for study, and, 4) both were utilized by the Maori, especially the totara. The kauri is restricted in its distribution, but grows to a much larger size and hence should produce longer ring records, providing the ring widths are generally much the same in size. The totara, more widely distributed if both species are considered, was preferred by the Maori for construction or carving; its life span is shorter, however.

Kahikatea *(Podocarpus dacrydioides)* and matai *(Podocarpus spicatus)* may offer possibilities, but were not fully investigated. Most of the other species appear unusable because of poorly defined rings, short records, eccentric or irregular growth, complacency, habitat, or some other feature associated with the trees of these species.

Collection of Specimens

Wood specimens were collected from four major localities on the North and South Islands. These were in the area around Auckland, including the Waitakere Reserve, and the Mt. Egmont region of Taranaki on the North Island, the Banks Peninsula in Canterbury and southern Otago on the South Island (see Figure 1).

Specimens were selected in the field according to principles already established in the United States (Glock, 1937); all specimens, together with their associated data, remain in the collections of the Auckland Institute and Museum at Auckland, New Zealand.

Analysis of the Specimens

A study of the various specimens by the use of skeleton plots and comparisons on the actual wood indicate that only a few samples from the Auckland area crossdate. It was not possible to crossdate specimens from Taranaki, Canterbury, or Otago; no similarities in growth patterns could be established between any two trees.

Within the Auckland district, specimens of kauri, totara, and white pine reflect similar growth patterns over a period of years. The patterns for kauri differ from those contained in the totara, although the totara and white pine are similar.

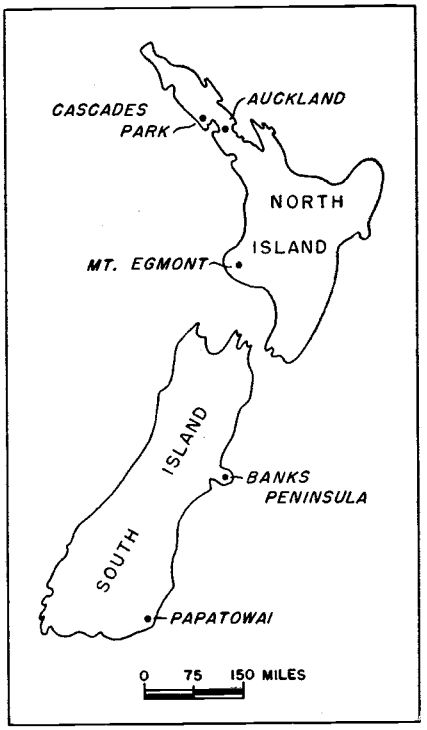

FIGURE 1. Outline map of New Zealand showing localities where tree-ring speciments have been collected.

Comments and Discussion

Crossdating of several kauri specimens from the Cascades Park area, about 20 miles north of Auckland, is indicated by the examples shown in Figure 2 (A). This suggests that it may be possible to build a master chart using kauri for dating archaeological materials. The kauri ring records are fairly clear, double rings are not especially troublesome, and trees with a long ring record can be obtained.

Two groups of totara exhibit similar growth patterns: one group is from the McKenzie area about 15 miles north of Auckland, Figure 2 (B), the other from the Auckland Domain in the city of Auckland, Figure 2 (C). Although these two groups are no more than perhaps 15 miles apart, different patterns are indicated for the two areas. This suggests that two tree-ring growth areas are involved, and that a separate master chart would be needed for each locality. With effort and careful selection of specimens, it may be possible to construct a master chart based upon totara. The totara ring patterns are difficult to read, however, confused by false rings, commonly distorted in growth, and often lacking in circuit uniformity. Work with totara should proceed by use of complete cross-sections rather than increment borings to facilitate detection of erratic growth.

Although little work was done with white pine, specimens examined indicate that further study should be done. One specimen crossdates with totara, suggesting that both species could be used for the construction of a single master chart which would apply to either tree. Moreover, the oldest ring record obtained (1438 to 1955) is a specimen of white pine.

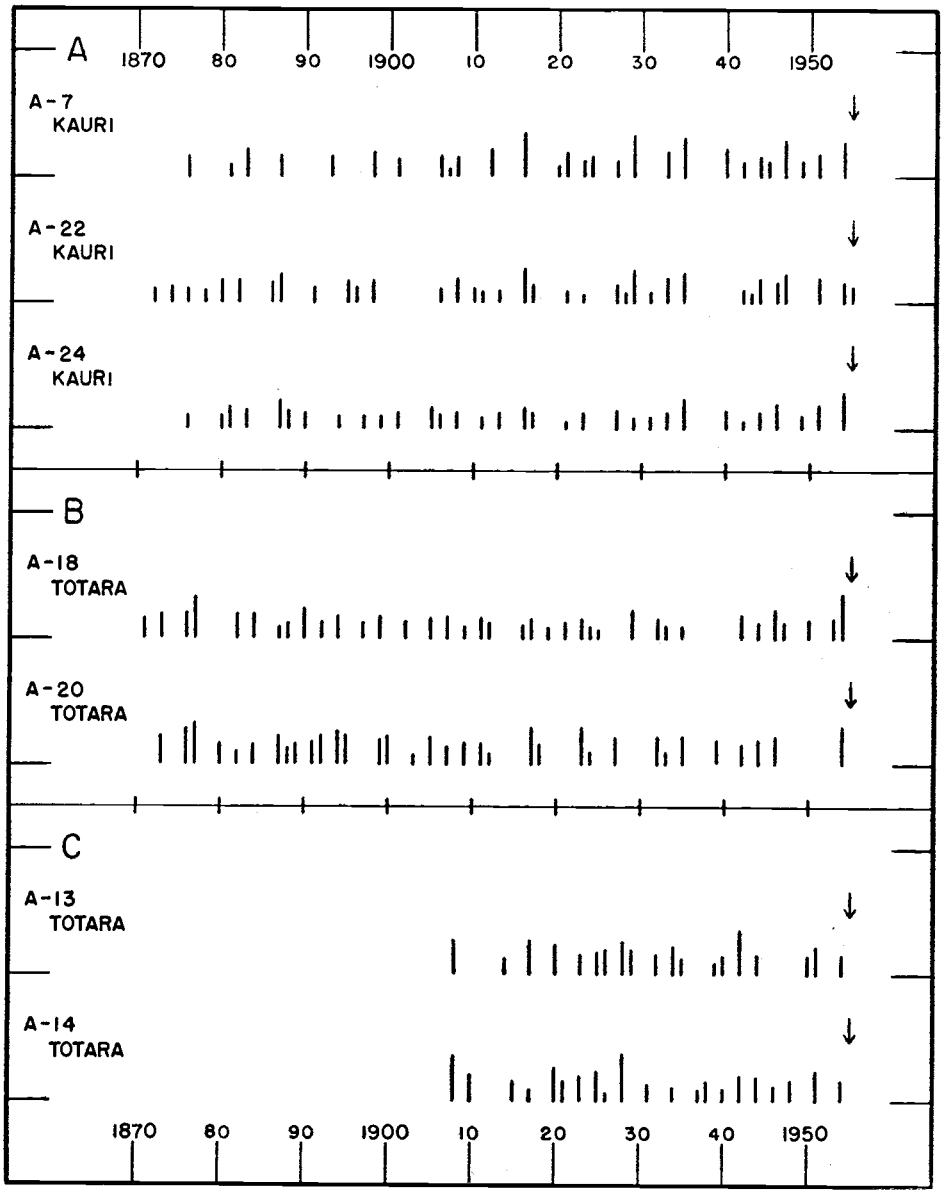

FIGURE 2. Skeleton plot crossdating in New Zealand specimens.

Summary and Conclusions

From a study of tree-ring specimens throughout New Zealand, it appears that it should be possible to construct master charts, for archaeological dating, of kauri, totara, and white pine for the Auckland district.

It is possible to establish a minimum age date for archaeological sites by ring counts from trees found growing on top of the sites. Samples have been collected from three such sites in Otago, and the following minimum age dates are indicated:

Hina Hina midden - - - over 240 years
Pounawea midden - - - over 219 years
Papatowai midden - - - over 256 years

It is also clear that tree-ring studies will progress slowly. Aside from the absence of basic botanical data which could be of considerable aid, crossdating is extremely difficult. Apparently local conditions are so variable that broader climatic factors become hidden or distorted so that crossdating is impossible in the majority of specimens. Many trees lack circuit and vertical uniformity, are subject to periods of compressed rings, or have ring structures which are difficult to read.

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THE ORIGIN OF DRIFTWOOD ON NUNIVAK ISLAND, ALASKA

JAMES W. VAN STONE

During the summer of 1952, a series of Swedish increment borings were collected from driftwood logs at various points along the coast of Nunivak Island, Alaska. The purpose of the sampling was to determine, if possible, the source of the spruce logs which have drifted ashore on the island, and to provide information to aid the study of northern ocean currents.[1]

The first studies on the origin of Alaskan driftwood were carried out by Giddings.[2] His main interest was in crossdating the various driftwood structures along the Bering Sea coast and the Arctic Ocean, but he noted also that the source of driftwood could be determined, an idea which was discussed in a 1952 driftwood study.[3] In 1951, Oswalt published a paper on the origin of driftwood at Hooper Bay, Alaska in which he demonstrated the crossdating of thirteen samples with Giddings' Series A driftwood master plot and one with the Series B master plot.[4] He was able to determine also that one driftwood sample came from the Stevens Village area on the Yukon River, and another probably from Nulato, also on the Yukon. In the course of their studies, both Oswalt and Giddings have stressed the necessity of developing chronologies for other Alaskan rivers comparable to that developed by Giddings for the Yukon.[5]

Living tree chronologies have been defined for much of interior Alaska and the Yukon River proper,[6] the forested area of Seward Peninsula,[7] the Kobuk River,[8] and the Copper River.[9] During the summer of 1953, Oswalt collected living tree samples from below McGrath on the Kuskokwim River to the limit of spruce growth in the vicinity of Bethel, a distance of approximately four hundred miles.[10]

The problem of collecting an adequate number of driftwood borings on Nunivak Island is more complex than it is for certain areas of the Bering Sea coast. The north coast of the island receives a small deposit of driftwood while the swift currents that run between the island and the mainland prevent the deposit of many logs along the east coast. It is only to the south along the shores of Cape Mendenhall that sizeable amounts of driftwood are to be found, and these do not compare in number with the vast tangle of drift logs to be found in the Norton Sound area and elsewhere along the south Bering Sea coast.

A total of one hundred and eleven samples were secured from various locations on Nunivak Island, of which fifty were chosen on the basis of

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[1] The driftwood borings which are the basis of this paper were collected while the writer was conducting an archaeological survey of Nunivak Island. The survey was sponsored by the Arctic Institute of North America with funds from the Office of Naval Research and by the University of Alaska. The writer wishes to express his thanks to Mr. and Mrs. Robert Gibson, Alaska Native Service teachers at Mekoryuk, for their co-operation during the field season and to Mr. Wendell Oswalt who read the manuscript and offered many valuable suggestions.

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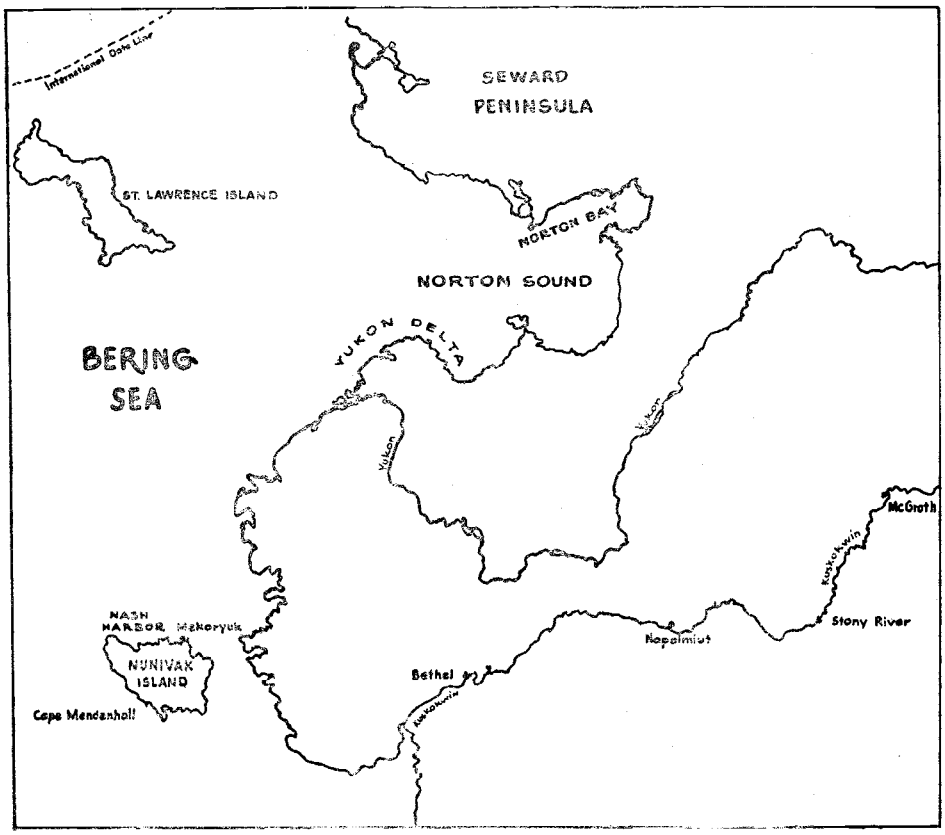

FIGURE 1. Map of the Bering Sea coast of Alaska. Scale: 1″ equals 50 miles.

growth sensitivity for skeleton plotting and comparison with the river chronologies. Of the fifty specimens used, thirty came from the Cape Mendenhall region, nine from Nash Harbor and vicinity, and eleven from the area around the villages of Mekoryuk, both located on the north coast of the island (see Figure 1). Some of the Mekoryuk samples are from logs probably brought up from the south side by the Eskimos as driftwood is scarce around the village and almost always has to be obtained from great distances.

The fifty samples plotted were first compared with Giddings' Series A and then the Series B master plots.[11] No crossdating could be determined from the comparison. The plots were then compared with the ten groups of Oswalt's Kuskokwim chronology,[12] and four dated as follows:

Nunivak Island Driftwood Number	*Number of Rings*	*Outer Ring*	*Closest Group Comparison*
1	185	1900	II, IV
2	210	1944	II, IV
3	210	1933	II, IV
4	189	1929	II, IV

It should be noted that in most cases the end dates listed do not represent the outermost ring of the tree, as all sampled logs had been stripped of their bark and they may have lost a few outer rings due to weathering. The four dated samples were measured in hundredths of a millimeter and the results plotted.

[11] Giddings, 1941, Figs. 13-19.
[12] Oswalt, 1954, Fig. 2.

It can be seen that all four of the Nunivak drift specimens crossdate most closely with the Kuskokwim Groups II and IV, from McGrath and Swift respectively. A mean of the dated samples is shown in Figure 2 together with the plots of Kuskokwim Groups II and IV. The Nunivak mean is presented in a scale three-fifths that of the two Kuskokwim Groups. The individual year-by-year group averages are recorded in Table 1. Although the Nunivak samples show a pronounced growth curve, the agreement in the first hundred years is quite good. The dated specimens show the greatest amount of sensitivity during the first eighty years of their growth.

The consistently small rings in Oswalt's Kuskokwim River series are A.D. 1793, 1802, 1809, 1826, 1885, 1910, 1912, and 1949.[13] With the exception of 1949, which is later than the end date of any of the Nunivak samples, key signatures surrounding these dates are present in all the dated Nunivak samples. The 1783 faint latewood ring,[14] which is often indistinguishable in the Kuskokwim River spruce,[15] is absent from the Nunivak samples.

In addition to the crossdating with Groups II and IV, each of the dated samples show a lesser amount of agreement with other Kuskokwim groups. All show a limited amount of crossdating with Group III (Vinasale). NI-3 and NI-4 show some agreement with Group V (Stony). NI-2 compares favorably with Group I (Herron-Castle). It is interesting to note that all of the crossdating is with Groups I to V which are up-river groups. This may be due to the fact that, although there are trees along the lower river, they are scattered and the likelihood of their contributing heavily to the amount of coastal drift is not great. Along the upper Kuskokwim River, however, particularly above Napaimiut, tree-growth is heavier and the river banks are less consolidated and are more apt to cave in during high water, thereby increasing the chances that coastal drift could come from this area. Thus it can be stated that probably all four of the dated Nunivak samples came from the upper Kuskokwim River, most likely somewhere between Stony River and McGrath.

Of the four dated Nunivak drift samples, three (NI-2-4) were collected in the Cape Mendenhall area while one (NI-1) came from the region around Nash Harbor on the north coast of the island. Since there is a general northerly flow of ocean currents from the southeastern Bering Sea region through the Bering Strait,[16] it is not surprising to find the

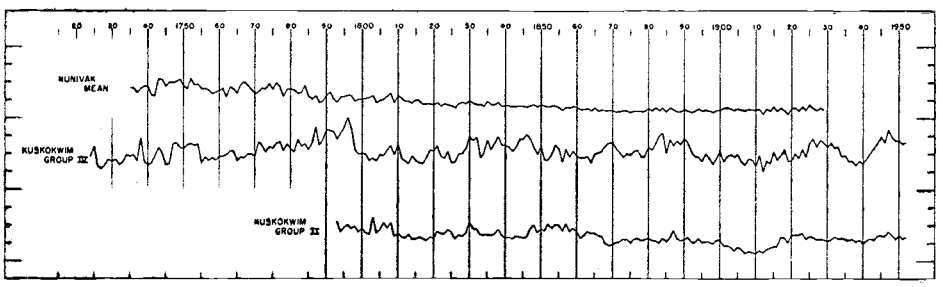

FIGURE 2. Crossdating between the dated Nunivak samples and Kuskokwim Groups II and IV. The graphically represented measurements are in one-hundredths of a millimeter.

[13] *Ibid.*, p. 207.
[14] Giddings, 1941, p. 72.
[15] Oswalt, 1954, p. 207.
[16] E. C. LaFond, *Arctic* 7: 100, 1954.

TABLE 1. Mean Ring-Widths of Dated Nunivak Island Driftwood Samples.

	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1730	—	—	—	—	—	42	42	35	41	44
1740	44	32	31	54	53	44	50	48	51	54
1750	44	41	55	46	47	42	42	39	34	36
1760	39	42	29	43	41	34	47	51	46	39
1770	34	37	43	40	48	40	49	43	30	40
1780	40	39	34	36	46	30	26	32	22	23
1790	31	37	26	22	29	30	32	31	23	26
1800	26	27	28	31	21	24	26	30	35	21
1810	31	27	23	23	21	25	24	18	19	19
1820	18	21	16	19	18	17	14	20	22	20
1830	24	20	18	18	16	23	18	18	22	16
1840	17	17	15	16	16	16	15	17	18	16
1850	18	17	15	17	17	15	11	15	14	16
1860	15	12	12	13	10	14	10	11	10	10
1870	10	08	09	10	10	08	10	10	09	10
1880	13	11	14	11	14	09	15	12	09	09
1890	12	10	08	10	13	10	11	10	08	11
1900	11	14	15	13	11	13	12	11	13	12
1910	12	13	06	13	10	17	10	15	11	06
1920	14	15	11	17	11	19	14	11	14	12

greatest amount of driftwood on the south coast of Nunivak Island. Driftwood coming from the mouth of the Kuskokwim and from other rivers south of the island naturally would be deposited in that area rather than on the north coast which would be bypassed by the northward moving driftwood. This may also account for the failure to date any of the Nunivak borings by using the Yukon chronologies. Most of the Yukon drift is deflected northward and does not come near Nunivak Island. It seems almost certain that much Kuskokwim driftwood must be deposited on the shores of St. Lawrence Island and a re-examination of drift and archaeological wood from that island in the light of Oswalt's Kuskokwim series might yield more satisfactory results than have been achieved with St. Lawrence wood in the past.[17]

One point yet to be mentioned concerns the small percentage of datable samples in the Nunivak collection. There are probably two main reasons for this. First of all, the collection is small because of the scarcity of driftwood and this limited the selection in choosing the samples. Secondly, local chronologies expressing microclimatic conditions are lacking from many of the rivers that undoubtedly contribute driftwood to the coast of Nunivak Island. It seems fairly certain that many complex, and at present unknown, factors (e.g. wind and ocean currents) are involved in the movement of driftwood, and these add to the difficulties of dating. Before these difficulties can be overcome, the establishment of more local river chronologies are needed, as well as the collection of more drift samples from the Bering Sea coast.

[17] Giddings, 1941, p. 41.

Cleveland, Ohio

TREE-RING CHRONOLOGIES IN SOUTH-CENTRAL ALASKA

W. H. Oswalt

The function of tree-ring studies in Alaska has been to establish regional chronologies for various localities, to date wood from archaeological sites, and to interpret the climatic meaning of tree-rings.* These studies have been pursued in a restricted manner, due largely to the limited number of adequately sampled areas. The purpose of the present study is to define the characteristic ring features of living trees in a previously unsampled area, south-central Alaska, and to relate the findings to the existing ring chronologies.

In Alaska the one consistently datable species, white spruce *(Picea glauca)*, has been sampled from the northern interior region, the Noatak-

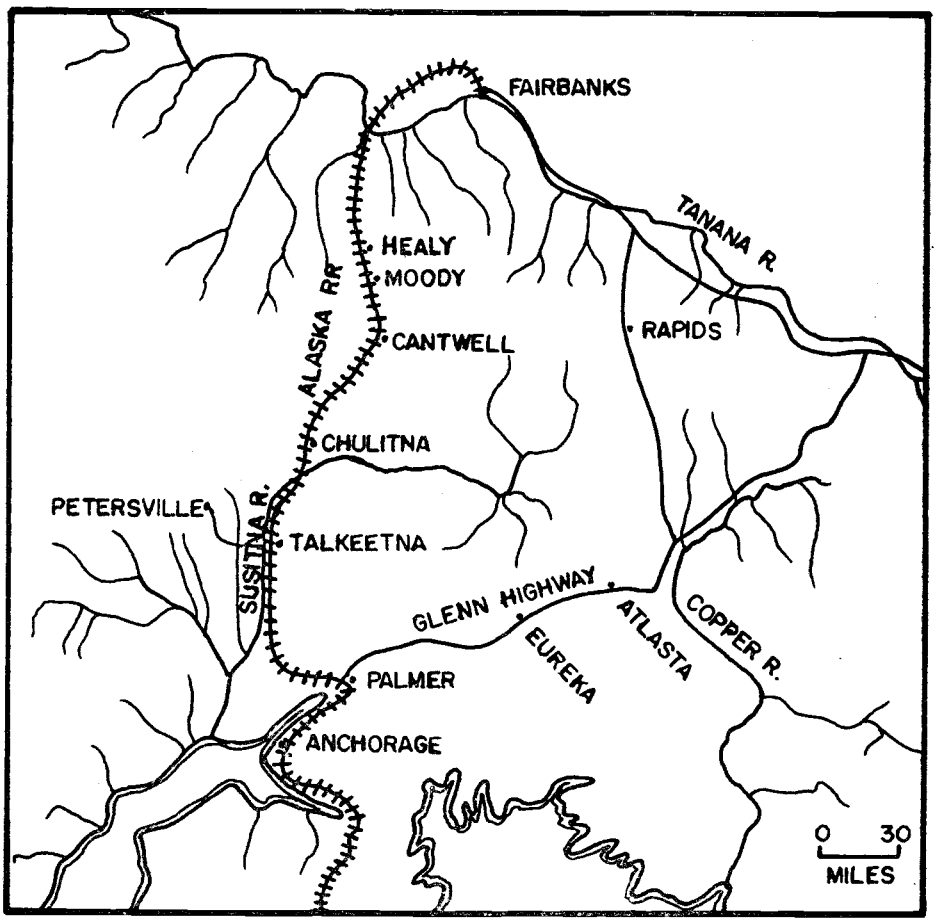

FIGURE 1. Map of south-central Alaska.

*There has been no attempt in this study to relate the principles and general techniques of tree-ring analysis to the growth indices. For a consideration of these, the reader is referred to the only definitive analysis of tree-ring principles as applied to Arctic America; Dendrochronology in Northern Alaska, by J. L. Giddings, Jr., *Univ. of Ariz. Bull.* 12, No. 4.

Kobuk area, and Seward Peninsula.[1] Chronologies were determined also for the lower Yukon, Copper, and Kuskokwim River areas,[2] while the current study delineates ring chronologies for the Susitna River drainage and adjacent areas of the Tanana and Copper River systems.

The white spruce sampled were growing in one general geographical region which contained varied ecological zones; the individual stands range from tree-line, at 2900 feet (all distances are approximate), to valley bottom at 350 feet. Collection sites were located in a roughly L-shaped area, with the community of Palmer as the axis, the north-south arm extending for 150 miles and the east-west arm for 110 miles (see Figure 1). All samples were collected in the fall of 1952[3] from points along the Alaska Railroad and the Glenn Highway. This is an area containing a relatively heavy human population; consequently many of the spruce have either been cut over or burned during the last fifty years, accounting for the short ring records of the trees in some stands.

The collection consists of one hundred and eighty spruce samples, all taken with the Swedish increment borer. Each sample was processed for analysis in the standard manner, i.e., surfacing the cores, visually selecting the cores with the greatest over-all year-to-year variation in ring thickness (which numbered forty-four specimens in this collection), measuring each ring in hundredths of a millimeter, plotting the measures on metric paper, comparing similar measured pieces in the same stand, and averaging the most sensitive individual pieces to form six regional groups (see Table 1). The groups were then compared with similarly processed samples from other Alaskan localities. A summary of the ecological position of the trees and other pertinent data for each group in this study follows.

Group I, Moody. This stand of white spruce is one mile northwest of the Alaska Railroad station of Moody on the north-eastern border of Mt. McKinley National Park. These trees grow at tree-line in a rugged mountain area along the upper Tanana River drainage and form a separate unit from the small, stunted, wind-contorted trees clinging precariously to the steep mountain sides and growing at the upper limit of the species. The stand is widely scattered on a well-drained, steep slope where there is a thin soil layer on top of the rocky glacial till; the ground cover includes mainly short grasses and scattered patches of willows. The region is subject to strong winds, which blow through the steep and narrow north-south pass, but the sampled trees are sheltered from the wind and are not noticeably abberant in their external growth characteristics. Each of the three individual measured trees from this group contains approximately 150 rings.

TABLE 1. Average ring widths of the six specimen groups in south-central Alaska. All figures given are in hundredths of a millimeter.

I. MOODY

	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1840	19	28	33	36	35	31	31	32	37	32
1850	39	32	36	40	37	43	42	48	42	27
1860	22	18	20	25	25	22	18	21	17	17
1870	17	20	18	14	21	26	29	20	19	21
1880	19	19	21	11	18	17	18	20	18	13
1890	19	23	21	22	31	19	11	14	21	22
1900	24	23	17	19	18	20	13	18	28	32
1910	30	31	23	23	18	16	21	18	15	19
1920	28	27	19	27	16	22	17	19	29	28
1930	31	21	34	36	37	40	44	36	33	25
1940	33	21	26	45	40	49	51	48	48	51
1950	59	54	66	....	....	....	....	....	....	....

[1] J. L. Giddings, Jr., *University of Arizona Bulletin* 12, No. 4, 1941; *Tree-Ring Bulletin* 18: 2-6, 1951.

[2] W. H. Oswalt, *Tree-Ring Bulletin* 16: 26-30, 1950; *Tree-Ring Bulletin* 19: 5-10, 1952; *Anthropological Papers, University of Alaska* 2: 203-214, 1954.

[3] The collection of these tree-ring samples was made possible by a grant-in-aid from the University of Alaska. The funds were kindly made available to the writer by Dr. Ivar Skarland, Head, Department of Anthropology, of the same institution. The field collection was made with the assistance of James Van Stone; Dr. J. L. Giddings, Jr. and Mr. Terah L. Smiley read the manuscript and offered helpful criticisms.

II. Cantwell

	0	1	2	3	4	5	6	7	8	9
1760	....	....	46	49	41	39	47	47	40	46
1770	45	34	43	39	48	47	55	47	45	45
1780	38	40	32	29	23	27	28	29	24	27
1790	27	29	31	34	29	33	28	30	21	23
1800	26	30	39	44	28	23	30	24	28	22
1810	24	21	23	23	16	12	13	14	15	16
1820	15	16	13	17	14	12	10	13	15	19
1830	14	19	23	15	15	13	16	17	24	20
1840	19	21	25	25	26	17	18	19	22	19
1850	18	15	16	22	34	39	28	37	36	38
1860	33	41	43	39	37	41	34	46	42	34
1870	37	39	36	56	68	61	56	52	43	38
1880	43	46	48	42	40	41	44	33	42	36
1890	39	39	39	37	39	37	43	39	45	34
1900	28	28	28	32	29	31	36	29	33	28
1910	23	28	22	29	29	30	25	27	29	20
1920	27	24	21	24	20	20	19	23	21	26
1930	24	20	30	38	47	43	43	43	27	35
1940	27	31	30	38	36	37	40	38	52	40
1950	38	40	41	....	....	....	....	....	....	....

III. Chulitna

	0	1	2	3	4	5	6	7	8	9
1860	....	49	40	41	44	49	44	38	31	40
1870	48	42	48	46	42	47	49	31	24	33
1880	48	61	67	48	52	49	67	60	63	60
1890	74	63	61	64	57	47	53	48	41	46
1900	36	44	61	61	47	59	52	65	57	46
1910	37	32	31	39	37	53	40	56	53	45
1920	48	50	47	55	51	48	46	48	47	49
1930	42	31	60	60	46	52	45	27	27	33
1940	27	37	44	46	41	44	45	48	29	29
1950	29	36	33	....	....	....	....	....	....	....

IV. Talkeetna

	0	1	2	3	4	5	6	7	8	9
1850	....	....	....	....	114	111	115	105	113	119
1860	107	85	122	108	102	131	122	91	81	77
1870	85	121	113	96	169	91	106	76	81	57
1880	72	64	82	83	74	79	105	101	62	96
1890	77	58	69	91	60	48	58	52	44	44
1900	47	50	45	46	43	52	41	65	47	43
1910	33	30	37	45	50	108	73	78	71	66
1920	71	70	52	64	51	84	94	81	102	87
1930	116	94	129	110	90	84	77	70	96	75
1940	75	99	107	121	134	50	31	42	65	85
1950	93	95	96	....	....	....	....	....	....	....

V. Eureka

	0	1	2	3	4	5	6	7	8	9
1790	....	48	54	57	72	62	45	59	48	45
1800	36	58	45	43	37	34	37	36	43	35
1810	39	47	45	45	34	35	43	31	35	48
1820	40	40	33	47	37	33	29	33	45	50
1830	31	39	45	47	34	30	41	33	39	28
1840	33	36	35	39	47	31	40	39	53	36
1850	39	41	35	33	39	37	26	37	49	44
1860	41	37	42	45	50	47	45	52	37	34
1870	39	30	46	40	43	49	45	31	33	31
1880	33	40	37	36	46	39	45	31	49	40
1890	38	37	33	35	37	35	40	36	34	34
1900	27	29	32	27	20	33	30	25	24	23
1910	22	25	19	24	17	22	15	18	25	10
1920	23	20	18	20	19	12	14	18	13	15
1930	13	14	14	19	18	18	20	19	18	25
1940	20	25	22	28	26	23	22	25	40	23
1950	27	21	20	....	....	....	....	....	....	....

VI. ATLASTA

	0	1	2	3	4	5	6	7	8	9
1780	....	64	56	45	50	56	53	48	46	40
1790	39	69	62	70	87	83	72	73	57	53
1800	55	74	73	65	50	55	50	31	41	35
1810	42	37	36	36	31	34	41	33	48	48
1820	55	52	40	44	35	37	31	37	38	43
1830	35	34	46	42	40	39	39	36	40	26
1840	32	38	50	41	53	39	37	34	43	32
1850	32	32	30	31	37	35	30	39	40	41
1860	43	35	35	41	40	35	22	36	26	26
1870	27	29	30	31	35	37	35	27	29	24
1880	29	35	38	30	38	27	23	28	23	21
1890	24	25	26	27	33	27	25	30	27	25
1900	20	20	27	22	19	20	19	19	22	19
1910	16	19	17	25	21	24	18	19	16	12
1920	19	17	17	19	16	18	15	17	19	20
1930	19	19	17	19	19	22	24	21	19	22
1940	15	18	19	21	20	20	21	20	31	19
1950	19	21	22	....	....	....	....	....	....	....

Group II, Cantwell. This tree-line stand is two miles southeast of the Alaska Railroad settlement of Cantwell in the upper Tanana River drainage. It is located on a well-drained, gently sloping hillside. Moss and grasses grow in the thin soil layer on top of the glacial till. The A.D. 1783 "faint latewood" growth is apparent in four of a possible four specimens. The five trees comprising the group averaged 160 rings each.

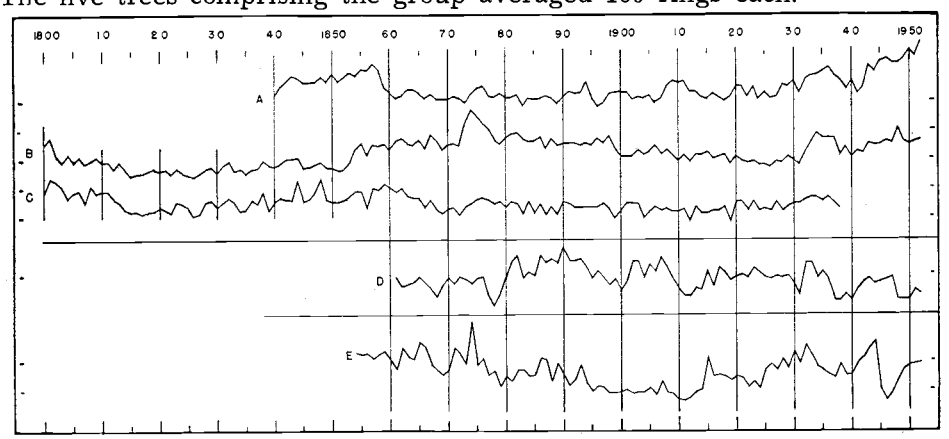

FIGURE 2. Group means for the Moody (A) and Cantwell (B) stands compared with Giddings' Alaska Range mean (C). The Chulita (D) and Talkeetna (E) groups follow.
Figures 2 and 3 are plotted at one-half the vertical scale of the other figures.

Group III, Chulitna. The four samples, averaging 110 rings each, are from a widely scattered stand at tree-line, located northeast of the Alaska Railroad station of Chulitna in the upper Susitna River drainage. Tree growth has been visibly affected by a prevailing northerly wind sweeping through the narrow pass; the north sides of the trunks have fewer limbs than do the south sides. The stand is growing on a small plateau area, with moss and grasses as the principal forms of undercover.

Group IV, Talkeetna. This valley bottom stand, four miles from the west bank of the Susitna River on the Peterville Road, is located on the northern crest of a low ridge at about 350 feet above sea level. The compact cluster of trees is growing on a thick layer of silty soil, with a moss and willow ground cover. The three Talkeetna samples used had slightly less than a hundred rings each and represent the longest ring sequences in

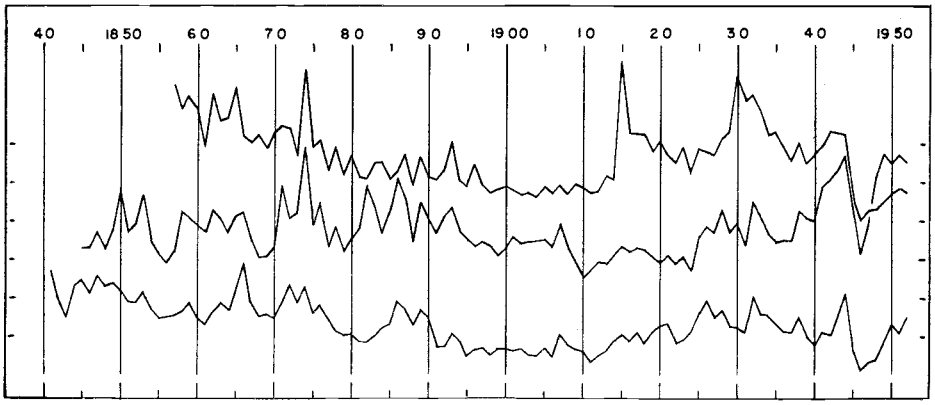

FIGURE 3. The plotted measures of three individual trees from the Talkeetna stand.

an original sampling of twenty cores. Measures of the individual specimens are illustrated in Figure 3.

Group V, Eureka. The four measured trees of this group, averaging 180 rings, are plotted in Figure 5. Samples were taken over an area nearly two miles in length from this widely scattered stand located near the upper forest border. The ground cover consisted mainly of a thin moss layer on silty soil. The location is at the western headwater area of the Copper River, 14 miles east of the Eureka Roadhouse on the Glenn Highway. While these trees do not have an extreme range in individual ring variation, they crossdate among themselves. One of a possible two samples has the distinctive A.D. 1783 "faint latewood" in evidence.

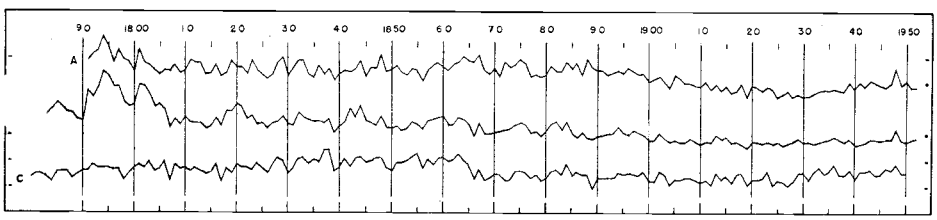

FIGURE 4. Group means for the Eureka (A) and Atlasta (B) stands compared with a mean for the Copper River (C).

Group VI, Atlasta. The four trees, averaging 175 rings each, represent a widely scattered stand 1,000 feet above sea level and in a marshy area with a thick ground cover of moss. This group is in the upper region of the Copper River drainage along the Glenn Highway near Atlasta Roadhouse. One of a possible three trees in this stand has the distinctive A.D. 1783 "faint latewood" present.

The individual ring widths for all the sampled trees range from 0.05 to 1.99 mm., and the patterns of large and small rings are traceable from tree to tree in the same stand. This consistency of ring pattern is commonly referred to as "local crossdating" and is graphically illustrated in Figures 3 and 5 for the Talkeetna and Eureka groups. As mentioned previously, after the similarity of tree-ring patterns had been established for a stand, the individual ring measures for each tree were combined into stand or group averages which could be compared with one another as well as with previously published data of a like nature. There is a graphic representation of the groups in Figures 2 and 4; the exact year-to-year ring averages for each group appear in Table 1. A visual com-

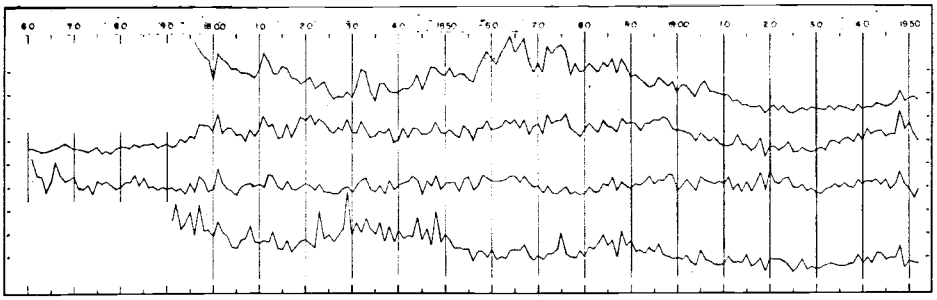

FIGURE 5. The plotted measures for four individual trees from the Eureka stand.

parison indicates the Cantwell, Eureka, and Atlasta groups have the most features in common, i.e., patterns of large and small rings, while the Moody, Chulitna, and Talkeetna groups vary from the former groups as well as among themselves.

A pertinent problem is the meaning of the above ring similarities and variances when related to previously published Alaskan tree-ring chronologies and to the local climatic picture. Visual comparison with other Alaskan chronologies demonstrates that the Cantwell, the Eureka, and the Atlasta groups have the ring characteristics of the widespread ring sequence designated "Series A Dating" by Giddings.[4] A further comparison indicates that the Eureka and Atlasta groups are most similar to Series A Dating as it has been defined from the Copper River.[5] The similarities in ring thickness make it reasonable to infer that the factors which influence the proportion of tree growth are essentially the same in the above localities. It should be noted also in this connection that mountains ranging in elevation from 5,000 to 15,000 feet separate the Alaska Range spruce trees from those growing in the Susitna and Copper River drainages. Giddings has demonstrated that there is a direct positive correlation between a small ring in a tree-line spruce and a low temperature for June and July.[6]

The three remaining groups, Moody, Chulitna, and Talkeetna, must be discussed separately because of the nature of their particular ring records. The Moody group, geographically situated between the Cantwell and Alaska Range groups,[7] has few diagnostic rings comparable to either of the latter (Figure 2). The divergence is undoubtedly related to the ecological position of the Moody stand which is in a narrow wind-swept pass, contrasting sharply with the open hillsides on which the Alaska Range and Cantwell stands are found. Essentially the same situation exists at Chulitna, where the trees are in the same type of wind-swept pass as well as being on a moist plateau. Again, the Chulitna ring pattern is local and has few rings diagnostic of Series A Dating.

The Talkeetna spruce are perhaps the most interesting of the entire series. These trees, growing near valley bottom, crossdate among themselves. Valley bottom crossdating of the type recorded at Talkeetna has been reported from the Fort Yukon-Stevens Village area of northern interior Alaska where it is termed "Series B Dating".[8] However, there is no over-all correspondence between the Talkeetna ring patterns and those of Series B Dating. It is possible that more extensive sampling of white spruce in the Talkeetna area would reveal that this distinctive cross datable ring sequence is to be found over a wide area.

[4] J. L. Giddings, Jr., *University of Arizona Bulletin* 12, No. 4, pp. 52-74, 1941.
[5] W. H. Oswalt, *Tree-Ring Bulletin* 19: 10, 1952.
[6] J. L. Giddings, Jr., *Tree-Ring Bulletin* 9: 26-32, 1943.
[7] J. L. Giddings, Jr., *University of Arizona Bulletin* 12, No. 4, Table 4, 1941.
[8] *Ibid.*, pp. 20-26.

Summary and conclusions. The analysis of a selected sample of white spruce cores from south-central Alaska demonstrates that two chronologies exist: the widespread Series A Dating and the purely local chronology. The former ring chronology is characteristic of spruce growing at tree-line on most mountain sides in interior and south-central Alaska as well as at tree-line on the Arctic coast where the tundra and taiga meet. Thus, in sensitive trees similar ring patterns may be found as much as 600 miles apart. Perhaps still more remarkable is the fact that, judging from a preliminary statement by Giddings,[9] spruce from the western shore of Hudson Bay have chronology characteristics like those of Series A Dating. The localized chronologies are probably linked to local microclimatic factors, and may, upon a refinement of interpretive techniques, offer an index to past localized summer temperatures.

[9] J. L. Giddings, Jr., *Tree-Ring Bulletin* 20: 24, 1954.

THE TREE-RING SOCIETY

October, 1958 Meetings

At a business meeting of the Tree-Ring Society on Saturday, October 11, 1958, members present decided to continue the Society and the publication of the Tree-Ring Bulletin. This decision was made after lengthy discussion regarding the problem and the reading of letters received from the membership at large.

Dr. Emil W. Haury was appointed to head a committee to draw up a slate of candidates for the various offices; election to be held at the next called meeting. This meeting was held at the Arizona State Museum on Tuesday, October 21, 1958. Officers elected at this meeting were: *President* – Dr. John C. McGregor, Department of Sociology and Anthropology, University of Illinois, Urbana, Illinois; and *Secretary* – Mr. Charles W. Ferguson, Department of Watershed Management, University of Arizona, Tucson, Arizona.

The newly-elected officers, according to Society by-laws, have appointed as editor and assistant editor of the Tree-Ring Bulletin: *Editor* – Mr. Bryant Bannister, Curator of Archaeological Collections, Laboratory of Tree-Ring Research, University of Arizona; and *Assistant Editor* – Dr. J. L. Giddings, Director of the Haffenreffer Museum of the American Indian, Brown University, Bristol, Rhode Island.

Charles W. Ferguson,
Secretary