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CHRONOLOGY OF THE KOBUK-KOTZEBUE SITES

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The continuous record, 970 years long, of spruce ring growth here treated was derived after three seasons of archaeological excavation in the Kobuk River area of northwestern Alaska and additional years of sampling tree growth in northern Alaska and Canada. Its climatic meaning, though inherent in the data, must as yet be interpreted with caution. Its application as a calendar of Eskimo prehistory is, however, immediate and definitive.

The Kobuk River valley was chosen in 1941 as an area for investigation because it is occupied at present by well-established Eskimo groups ranging far inland, whose ancestral sites, if found, would probably contain preserved wood of local origin. Crossdating in wood from coastal sites had proved feasible, but costly both in time and requirements of excavation, because the driftwood encountered in such sites is drawn from wide-spread sources. Since the whole of the Kobuk watershed lies near to the outer limits of tree growth, it was supposed that ring records from any section of the river would date readily with those from any other section and that here a long chronology to apply as well to the neighboring coastal sites might be most readily secured.

The number of archaeological sites discovered, mainly small groups of house ruins without accompanying midden, far exceeded expectations. Climatic changes between the "tree line" limit of growth at Kotzebue Sound and the headwaters of the river proved, however, to be greater than anticipated, complicating, though not too seriously, both discovery and interpretation. Ground frost on the lower river is permanently nearer the surface than on the upper river, where thaw penetrates the floors of partly-underground house ruins nearly every summer. This places a predictable limit on the preservation of the lowest building logs in such ruins, so that wood for dating from upriver sites is much scarcer than from those near the seacoast. The ring record in living trees closer to tree line, near the Kobuk mouth, is also more nearly identical with that in trees at a similar station 200 miles south on Norton Bay than with trees 150 miles up the Kobuk River.[1] Such differences are not enough to discourage archaeological crossdating but make necessary a generous overlap in chronologies representing several sensitive trees.

The field work of 1941 and 1942 has already been described to some extent, both as to archaeological status of the sites[2] and as to problems of dating.[3] An overlap had been suspected (ref. 2, p. 130) between a relative chronology worked out for four early sites and the dated chronology from living trees

[1]Giddings, Univ. of Ariz. Bull. 12: Univ. of Alaska Publ. 4, 1941, Figs. 6 and 8.
[2]Giddings, American Antiquity 10:113-134, 1944.
[3]Giddings, Tree-Ring Bull. 9:2-8, 1942.

and one old site. This junction was amply verified in 1947, thus affording a chronology, applicable over a wide area of western Alaska, which reaches back to A.D. 978.

Field Season of 1947. The University of Alaska, with funds supplied by Mr. Childs Frick, made possible a continuation of the project interrupted in 1942 by the war. The author, assisted by University anthropology students Wendell Oswalt, Ordway Southard, and John D. Sperry, excavated house ruins in the Intermediate Kotzebue Site, in the Ekseavik Site on Squirrel River, in a site near Kiana Village, and at several other points along the lower Kobuk.

Success in delineating the ring record through the early 1500's came at the intermediate site at Kotzebue, where many logs carrying bark or "near bark" dates were found to crossdate with the Ambler Island chronology and to overlap for a few definitive years the oldest of the living trees sampled in the area.

A full description of the sites excavated in light of their dating is reserved for a report in progress on the archaeology of the region, but some of the more technical and special problems encountered in bridging chronologies in this area are discussed in the following paragraphs.

Selection. The Kobuk Eskimos acquired the iron axe after white contact. Stone tools may have included an axe-hafted blade in earlier times, but the elbow adze has been at all periods the principal wood-working tool, as it has been in other parts of the Eskimo range. Perhaps this accounts largely for the increasing evidence that even in heavily forested areas the Kobuk people never made use of standing green timber. While the bark dates of log cabins built since gold-rush days clearly indicate the year of cutting and of probable construction, the bark dates from archaeological sites range through several decades in about the same proportions as at treeless coastal sites. This can mean only that dead logs, principally river drift, were secured and handled in about the same way as they would be on a barren coast.

The earlier houses were built mainly of spruce poles. After 1700 on the upper river the deep and permanent house gave way to a winter house, largely of soft birch and poplar, which was presumably occupied for only one or two seasons to judge by the thickness of floor deposits.

Our selection of specimens for dating is thus determined in large part by the selection of the builders. An effort is made to save sections of all spruce which is sound enough to be bound together in the field. Roof timbers are seldom more than a brown pulp which defies any treatment. Even those base logs and basal ends of vertical wall logs which appear sound on first exposure tend to crack and powder upon drying out, especially those logs which have been rapid-growing trees. The timbers which lend themselves best to preservation are, fortunately, those which have grown slowly and with considerable spiral in grain. For this reason the greater number of spruce sections which can be collected in the field are those which carry good ring records. When thoroughly dried out, many rotten sections can be saved by soaking in a gasoline-paraffin solution.

Origin of Drift. Assuming the use by the builders mainly of river drift, we are concerned with the areal diversity of the ring record. Sites along the banks of the Kobuk River must have derived their drift from some point upstream. Ambler Island Site could have received wood only from an

area in which little difference occurs in living tree records. Ahteut Site lies enough farther downstream for some modification to have taken place. Ekseavik can have derived drift only from the short upper reaches of Squirrel River and is therefore the most favorable site for crossdating. The Kotzebue sites, on the other hand, can have received drift from all of the Selawik, Kobuk, and Noatak Rivers. Specimens recovered from the Kotzebue sites are limited mainly to those small-ringed, spiral-grained logs which best resist decay. The sensitive nature of the dated records at Kotzebue suggests a predominance of Noatak drift, though the reason for such distribution is not fully understood. The limited forest on the Noatak River at present reflects the temperature of the growing season very closely in its ring widths, ring records duplicating, with greater sensitivity, the lower Kobuk records. Although some drift from the open ocean is not entirely precluded at Kotzebue, the position of the sites at the narrow mouth of Hotham Inlet favors a predominance of river drift.

Limiting Dates for Sites. The use of driftwood creates a special problem in estimating the times of building and abandonment of houses. Where only one construction log is dated for a house, we can only assume that building took place after the death (bark date) of this specimen. Actually, the house may have been occupied for some time before this log was added to bolster sagging walls. If, on the other hand, we have a large number of bark dates for the walls of a single house, we may arrive at a closer estimate of occupation, possible reconstruction, and abandonment. This is illustrated in House 11 at Ekseavik, the dating of which includes 32 sections in which the bark ring is dated, and 11 sections in which, because of microscopic or rotten outermost rings, the bark ring is uncertain but very approximate ("near bark"). Of these 43 end dates, distribution by decades is as follows:

A.D. 1300-1310— 1	A.D. 1360-1370— 7
1310-1320— 0	1370-1380— 6
1320-1330— 1	1380-1390—15
1330-1340— 0	1390-1400— 4
1340-1350— 2	1400-1410— 3
1350-1360— 4	

Building is indicated between 1380 and 1390, occupation and reconstruction during the following two decades, and abandonment after 1410. These figures are not unlike those earlier proposed for sites on shores of the open ocean (ref. 1, p. 80). Similar breakdowns for other Ekseavik houses, but based on fewer specimens, show that all houses were not occupied simultaneously, though the use of all but one seems to fall within the 50-year period 1380-1430. The inclusion of logs which died as much as eight decades before construction shows the danger of basing the dating of any site on limited material. Surface preservation of spiral-grained dead wood for a hundred years or more, where not exposed to swampy ground, appears quite usual in the arctic area. This observation is based especially on dated driftwood recently collected along the coast of the Arctic Ocean west of the Mackenzie River and almost certainly derived from the Mackenzie River Delta.[4]

Bridging of Records. The dated archaeological and living tree records, several hundred of each, upon which the Kobuk dating is based, have not yet been measured in full. Most of the curves shown here were derived from material collected in 1942 and earlier; these are supplemented by some critical specimens in the 1947 collections.

[4]Giddings, Tree-Ring Bull. 13:26-29, 1947.

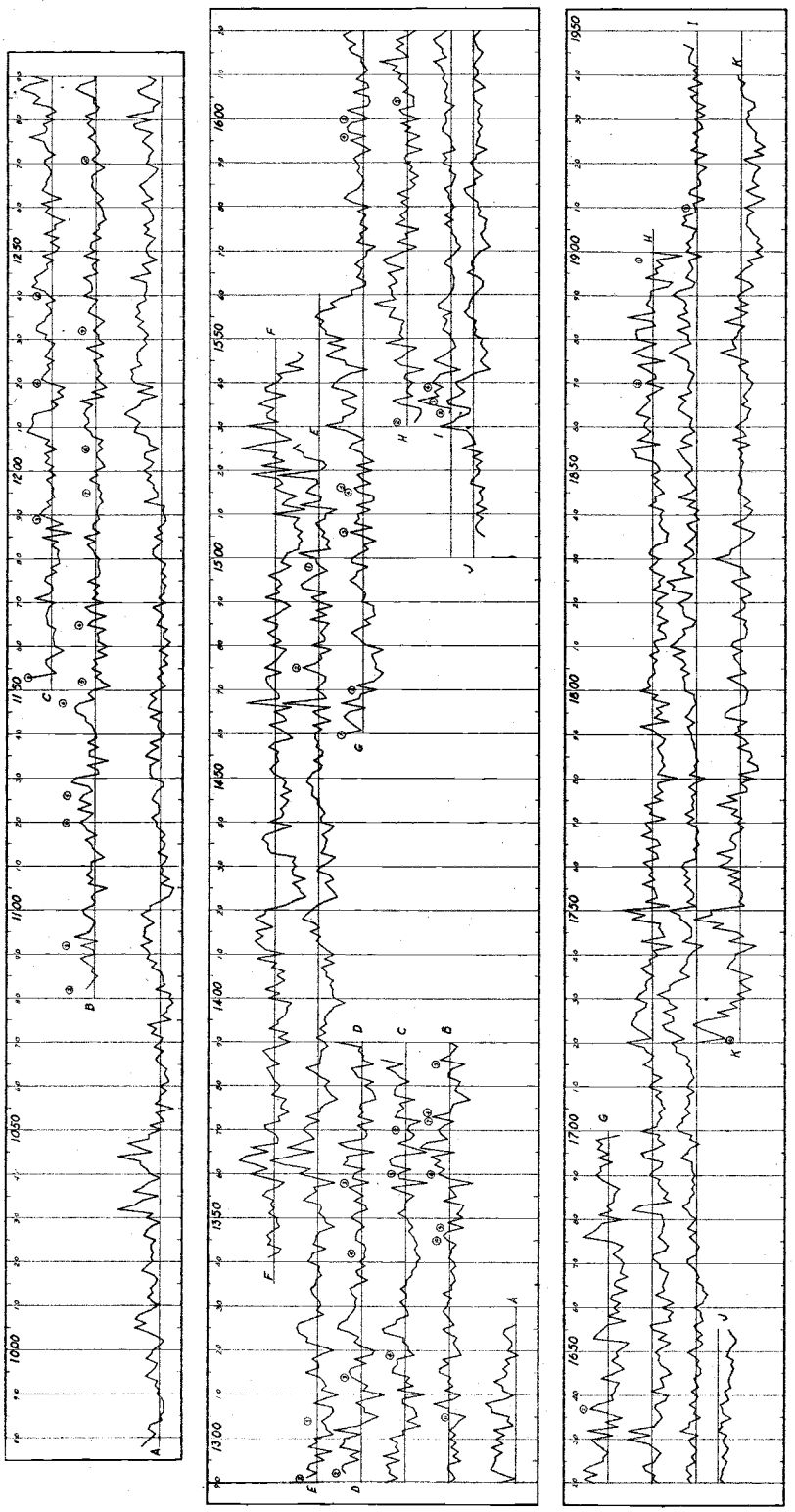

Figure 1. Growth series in the Kobuk-Kotzebue area. Circled figures along the curves give the numbers of specimens on which the curves are based. Some of the series represent unstandardized measurements of ring-widths (see text); the horizontal reference line for such series is not at the mean value.

Table 1. Tree-Ring Indices for Spruce in the lower Kobuk Area: Ring-Widths in Per Cent of the Growth Trend.

A.D.	0	1	2	3	4	5	6	7	8	9
970	....	....	....	....	....	....	....	....	146	112
980	112	96	120	112	70	78	58	58	58	70
990	87	78	95	87	128	112	95	87	129	112
1000	104	79	62	87	125	170	129	170	154	113
1010	87	112	120	104	112	95	87	103	146	128
1020	104	112	103	112	112	95	137	129	112	79
1030	129	103	237	171	146	87	179	145	120	79
1040	120	129	154	154	241	116	170	209	129	132
1050	88	136	72	93	115	35	108	100	101	71
1060	105	62	75	88	78	117	143	133	110	166
1070	130	119	193	167	230	71	152	107	109	62
1080	95	80	114	105	98	89	102	96	114	125
1090	96	99	126	89	140	106	101	95	101	119
1100	122	101	95	104	95	69	110	98	113	104
1110	104	104	75	90	98	104	116	92	112	116
1120	127	110	98	134	104	130	122	101	110	146
1130	139	87	89	113	66	107	107	87	110	92
1140	95	98	101	116	116	136	141	130	98	110
1150	98	63	82	95	80	102	90	97	70	92
1160	69	90	87	92	72	112	102	73	107	116
1170	77	102	89	99	87	114	89	85	89	90
1180	86	97	102	113	99	122	86	104	103	88
1190	92	93	90	78	87	83	91	88	110	93
1200	100	75	83	92	95	81	90	79	104	108
1210	123	112	114	122	116	102	129	80	104	70
1220	83	93	82	90	89	99	78	94	115	76
1230	90	87	100	87	74	93	111	107	99	91
1240	121	104	104	106	123	93	101	104	87	122
1250	97	108	105	83	102	86	90	73	78	78
1260	84	92	76	88	99	105	102	105	94	75
1270	89	104	92	86	92	98	112	97	100	114
1280	103	118	94	89	101	98	118	140	128	97
1290	97	82	88	97	97	70	86	74	89	80
1300	92	80	94	81	75	60	97	97	130	86
1310	71	107	86	98	92	119	119	97	112	68
1320	75	81	86	79	98	114	85	95	103	112
1330	103	100	93	113	91	92	82	85	92	82
1340	85	97	93	93	80	100	110	97	64	99
1350	64	78	68	64	109	79	86	97	44	97
1360	120	106	131	116	138	84	164	148	100	115
1370	122	108	86	136	95	92	87	52	66	79
1380	78	71	94	100	106	77	93	88	88	73
1390	82	98	79	93	76	81	78	68	59	35
1400	60	64	64	68	63	76	76	88	60	82
1410	63	75	89	100	91	114	93	104	132	122
1420	110	99	83	54	62	72	80	63	71	99
1430	88	73	57	90	81	81	76	87	73	63
1440	88	92	83	90	98	98	113	110	111	124
1450	118	112	95	89	106	91	87	101	97	105
1460	104	87	109	69	95	107	70	176	78	86
1470	104	95	81	81	101	133	104	89	93	67
1480	113	84	84	93	84	73	115	78	101	67
1490	95	113	87	133	136	118	104	78	76	91
1500	90	104	55	61	54	66	58	74	79	62
1510	92	42	111	82	71	102	107	89	96	172
1520	74	126	74	100	92	171	120	58	85	95
1530	159	86	115	115	97	195	245	155	175	135
1540	185	165	145	55	125	175	135	105	75	85
1550	95	105	135	125	115	135	95	155	155	125
1560	105	95	85	85	85	95	95	125	115	85
1570	75	55	75	75	95	95	125	85	125	95
1580	85	95	105	105	125	95	85	75	105	95
1590	135	115	135	75	95	95	105	135	135	115
1600	115	125	105	85	125	115	125	115	115	135
1610	125	135	145	175	115	135	135	165	175	145
1620	115	135	115	135	135	95	115	95	95	115

A.D.	0	1	2	3	4	5	6	7	8	9
1630	125	85	165	125	125	75	105	95	125	95
1640	85	115	85	95	105	75	75	95	85	105
1650	135	85	65	95	65	95	105	65	75	75
1660	105	65	55	45	65	65	95	85	95	105
1670	135	135	95	95	85	103	120	92	130	110
1680	90	117	125	142	114	111	92	101	91	99
1690	89	97	96	95	134	109	100	67	98	89
1700	136	143	119	117	93	107	91	91	98	75
1710	96	88	73	80	79	93	85	91	124	124
1720	136	95	127	152	159	125	131	155	116	135
1730	139	171	135	135	117	79	106	100	87	88
1740	89	69	43	104	77	78	79	93	115	116
1750	136	95	127	152	159	125	131	155	116	135
1760	119	112	74	74	82	67	76	77	69	78
1770	112	86	118	85	92	83	90	74	96	81
1780	41	94	71	79	63	70	70	76	76	83
1790	82	90	97	75	103	88	81	67	74	74
1800	103	103	103	110	89	117	103	110	146	102
1810	153	131	117	103	110	74	67	103	109	109
1820	124	96	81	144	138	169	74	110	102	124
1830	96	74	81	103	88	74	67	88	95	60
1840	74	60	95	67	124	88	67	81	88	102
1850	81	81	95	110	116	131	81	116	102	74
1860	88	88	81	102	124	117	102	124	81	95
1870	88	81	74	95	88	95	124	160	132	88
1880	95	95	131	88	95	132	95	112	102	112
1890	145	133	82	75	106	98	83	92	100	55
1900	109	94	109	88	88	72	128	112	120	83
1910	83	90	52	108	100	69	69	77	70	45
1920	87	89	46	106	81	90	81	101	65	74
1930	94	58	94	59	95	113	88	125	70	108
1940	89	108	91	130	130	123	112	152	....	....

Figure 1 includes 11 curves arranged to show crossdating between group averages and individual trees as well as the bridging of relative and actual chronologies. Curve identification is as follows:

A. A single wall post, 348 years from center to bark, from Ekseavik (House 11, No. 9, 1947). Measured ring-widths.
B. 2 to 11 Ekseavik logs from several houses averaged, and the final curve standardized to remove age trend.
C. 2 to 5 Old Kotzebue logs from 3 houses averaged, then standardized.
D. 2 to 4 short log records from Old Kotzebue houses averaged, then standardized.
E. 1 to 3 logs from Intermediate Kotzebue averaged, then standardized.
F. A single log from Intermediate Kotzebue (House 8, No. 27, 1947) standardized.
G. 1 to 5 logs from Ambler Island houses averaged, then standardized.
H. 2 to 3 logs from a standing log house currently occupied at the village of Kiana, mouth of Squirrel River, standardized separately, then averaged.
I. 3 living trees and 1 standing dead tree from a riverside stand of timber some 20 miles up Squirrel River. Average of measures.
J. The earlier rings of an exceptionally long-lived specimen from Kiana Site, House No. 1. The outermost rings of this log are microscopic and uncertain, but bark is in the neighborhood of 1850. Measured ring-widths.
K. A group of 6 trees alive in 1941 at Hunt River, between Ambler Island Site and Ahteut Site. Average of measures.

A working index for the lower Kobuk River area, selected from these series, is given in Table 1. It is based as follows: A (978-1080), B (1081-1376), B-E (1377-1385), E (1386-1497), E-F (1498-1519), F (1520-1534), I (1535-1947).

Before the 1947 field season, the actual chronology consisted of living trees in the area of Ambler Island bridged with Curve G, from the Ambler Island Site, plus corroborative curves from living trees in neighboring areas. The relative chronology from older sites included Curves B, C, D, and E. An overlap was suspected, but it was not counted upon in view of the geographic separation of the Kotzebue Site from the Ambler Island Site, especially since the Kotzebue curve included only one specimen

for its latest 29 years. Curve F is chosen from a group of about 20 specimens from the 1947 Kotzebue excavation ending with bark between 1500 and 1550 to confirm and extend Curve E. Curve J illustrates an extension backward in time to the center of a recent specimen, the first 20 or more rings of which are slightly eccentric. Curve K is included to show the type of agreement between upper Kobuk and lower Kobuk living trees, which is assumed to be proportionate to that between Curve G and those contrasted curves with which it is contemporary. If Kotzebue curves are derived, as suspected, mainly from the Noatak River, this offers no obstacle to crossdating, as shown by their relation to Ekseavik curves.

In view of the long ring records so often available in the Kobuk dating material, the problem of bridging chronologies appears at first glance fairly easy. But comparison of the curves in Plate 1 with any similar plate of archaeological dating in Arizona and other localities along a lower forest border shows that in the north we are dealing with much less sensitivity to climate in the individual tree than is the case in moisture-controlled areas. This has been expressed by Schulman[5] in coefficients of mean sensitivity, an index proposed by Douglass. The Hunt River group curve (Plate 1, K) is rated in mean sensitivity at .16 as against .38 for a group mean for Douglas fir at Mesa Verde, Colorado. Crossdating in the north thus demands in most cases more than a short overlap between two specimens and involves first of all an understanding of the rates of departure in average growth trend from one area to another. It should be stressed, however, that (regardless for the present of climatic meaning), sensitivity is much higher than the average over short time intervals throughout the data. Although without regularity, these intervals average about 70 years apart in the Kobuk chronology. Periods of this kind may be noted centering about the following "signatures": 1912-1922; 1742-1751; 1534-1543; 1358-1365; and 1205-1219. Such periods of increased sensitivity may agree in the main across areas in which crossdating is otherwise not practicable; they always furnish valuable checks to dating in even the most closely related material.

Culture Changes Through Time. Estimated dates for periods of building in the major Kobuk sites, as based on end dates of their house timbers, are as follows: Ahteut, 1200-1250; Ekseavik, 1380-1420; Old Kotzebue, 1350-1400; Intermediate Kotzebue, 1500-1550; Ambler Island, 1730-1760.

Some definitive traits and complexes appear to be delineated in time as follows:

1. Thule types harpoon heads—earliest (Ahteut) through 1400.
2. Paddle-impressed pottery—earliest through 1400.
3. Textile-impressed pottery—earliest through 1400 (scarce after 1250).
4. Geometric heavy-line engraving—Ahteut only—1250.
5. Typical Thule engraving—after 1250 through 1400—decadent thereafter.
6. Deep cold trap in house construction—earliest through 1400.
7. Points of flinty material—striking changes after 1250, after 1400, and after 1550; recent types evolving by 1550, stable after 1700.
8. Dog traction—sled shoes and parts of built-up sledge first appear 1500-1550; swivels, etc., after 1700.
9. Jade—sporadic and scarce before 1550; jade industry replaces slate industry after 1700.
10. Labrets—first appear Intermediate Kotzebue, 1500-1550.
11. Armor plate—after 1400; absent in upriver sites.
12. Fish netting—all periods.

[5]Tree-Ring Bull. 13:10-24, 1947.