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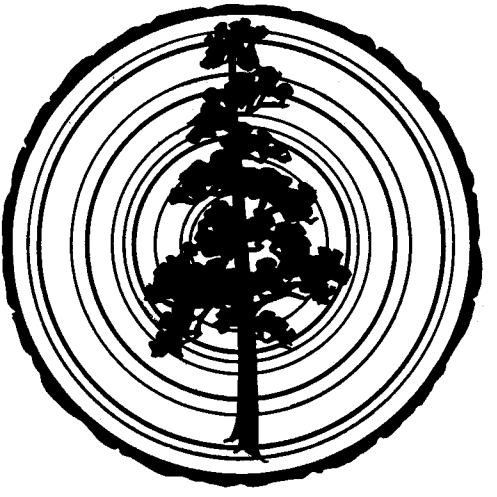

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THE APPLICATION OF TREE-RING DATES TO ARCTIC SITES

J. L. GIDDINGS, JR.

Wood, to judge from archaeological evidence, has always played an important part in Eskimo economy. Where driftwood is scarce, especially east of the Mackenzie River in northern Canada, the coast people have developed substitutes for wood; they build snow houses, construct sledges of frozen skin, and make even bows and shafts of cleverly spliced lengths of bone. But the value of wood has not been overlooked even in these exceptional regions; every scrap of driftwood is collected assiduously, and long pilgrimages are made inland to the scattered fringes of forest, where wooden implements and shafts are roughed out on the spot. Along the open shores of the Arctic Ocean and the Bering Sea, however, apparently no shortage of wood has ever been felt. On the other hand, and fortunately for tree-ring study, the Eskimos have never considered driftwood so abundant as to be used indiscriminately as fuel.

On a flight along the coast from Kotzebue to Point Hope, in western Alaska, one sees logs lying on the beach everywhere except in the vicinity of Eskimo camps. Some of this material seems to have been the accumulation of decades, but a certain amount of it must have been washed up during each open season. The abundance of driftwood still has its significance to a large community. Tigara, the village at Point Hope, has a present population of about three hundred Eskimos who are housed throughout the winter in some forty or fifty "igloos." The term "igloo," the Eskimo word for house, more correctly applies to the sod house, which, in contrast to many villages to the south, is still in vogue at Tigara. Several frame buildings are occupied by natives who can afford the coal necessary to heat them, but the majority of the houses are modelled after those in use before European contact. In the framework of the modern igloo, however, milled lumber is largely used in place of driftwood, and although the form of the house and the sod covering have not changed, the demand for driftwood as a building material cannot be as strong as it was before whaling days. The modern igloo consists of a rectangular room, varying in size, floored with planks, and roofed with a gently sloping frame of logs and planks. A rather long, tunneled entrance of either logs and planks or whale bones extends between the inner and the outer door. The whole structure is covered with a thick layer of sod blocks, insulating all but the skylight and the optional window or two. Whale ribs

and jaw bones are used rather than logs and poles for many of the structures outside the igloo, such as boat rack and food cache.

In contrast to the modern igloos are those built before whaling days, some of which have been excavated in the large mound near the present village. The walls, roofs, and floors were constructed of driftwood logs and poles, as well as rough-hewn planks, with whale bones strongly in evidence. Many utensils in these old houses were made of driftwood.

Assuming that the amount of driftwood reaching these northern shores has not changed greatly for several hundred years, its collection must have extended, in times before European contact, far along the coast both to the north and south of Point Hope. Today, native beachcombers pick up even small sticks, piling them at intervals on a high section of the beach. When a new log is discovered, it is dragged away from the water's edge, and the finder chops his mark or initials plainly on an exposed surface. Present conditions at Point Hope indicate that an Eskimo community in the western Arctic in prehistoric times must have been limited by its supply of driftwood almost as definitely as by its available food supply.

The first crossdating of Alaskan trees in 1937 suggested an application of tree-ring methods to Eskimo archaeology. With ground frost as a medium of preservation, it seemed likely that a long, continuous time sequence might eventually be worked out from house timbers and wooden utensils recovered from the several sites in process of excavation. H. B. Collins, in the course of his excavations of Eskimo ruins, was perhaps the first to preserve sections of house timbers specifically for study, but he had doubted that "the methods of dendrochronology can be applied successfully to Arctic driftwood."[1]

The conditions upon which the dating of driftwood depend are the following: 1) that a large proportion of available specimens have grown in one area of essentially homogeneous climate and 2) that in this area the trees react similarly to fluctuations in one or more climatic elements. If these conditions exist, then it should be possible to crossdate individual specimens to form a floating chronology, and eventually to join this chronology to the modern sequence in living trees.

These conditions were realized in the winter of 1938-9, when Dr. Froelich G. Rainey made available for tree-ring study the collections in the University of Alaska Museum. Out of several thousand wooden artifacts and fragments procured mainly from the Kukulik Site on St. Lawrence Island, approximately three hundred carried ring records long enough to warrant plotting. Out of these, twenty-seven specimens were first crossdated, then identified with the prevailing sequence already worked out from living trees in the region of the Middle Yukon, a sequence which has been tentatively identified with mean June temperature. Another strong sequence which could not be actually dated occurred in several pieces of wood, and this, along with other bits of independent crossdating, was temporarily set aside. It became clear that in order to date driftwood an effort had to be made to collect wood carrying either comparatively short ring sequences of great sensitivity or long sequences of more than 150 rings, and preferably a combination of the two. This has partly to do with complacency in a great deal of datable Alaskan wood, but principally with the improbability of obtaining more than one specimen of driftwood which has grown in the same timber stand in the interior. A long ring record carries enough dating characters common to the whole area to overcome misleading local aberrations.

[1] Collins, H. B., Jr., The archaeology of St. Lawrence Island, Smithson. Misc. Coll. *96*, 255-256, 1937.

On the recommendation of Dr. Rainey the writer became a member of the Point Hope Expedition of 1939. During that summer at Point Hope, on the journey by Coast Guard cutter with stops at points in Bering Strait, and during two months of the fall on St. Lawrence Island, collections were made of representative samples from both old house sites and standing structures built of driftwood. This additional material made possible an application of driftwood dates to Eskimo sites.

In the wooded interior it is a comparatively simple matter to find the exact year in which a log cabin was constructed. In the case of one abandoned cabin, built near the beginning of this century, the outside (bark) dates of the logs showed that most of the logs had been cut after the growing season of one year and the rest of them during the growing season of the next. In instances of this sort it is assumed that we have found the specific year of building. In the case of a house built of driftwood on an arctic coast near which no trees grow, however, it becomes obviously impossible to find by tree-rings any single date which concerns the Eskimos. What, then, is the significance of driftwood dates, and to what extent can they be employed to determine Eskimo chronology? The following observations, based upon 97 dated pieces of driftwood, answer these questions in part.

Bowls, platters, trays, cutting boards and other articles of Eskimo manufacture of the kinds recovered from archaeological sites seldom carry bark dates, but poles, hewn planks and other wooden units of house and cache construction nearly always do. Within the walls of a particular buried house, however, at least a few of the utensils, and likely the majority of them, carry rings close to the outside of the log from which they were fashioned, and by dating a number of these utensils the most recent date to which any of them attains is obviously nearest to the final occupation of the house. This date automatically sets a time limit beyond which the occupation of the house must have extended. It is to be expected that a number of end dates in these utensils will approximate the limiting one. A similar test is made of the house logs, the dates of which are likely to fall comparatively nearer the limiting log date, since these are usually all bark dates. The most recent log date sets a limit beyond which the construction of the house must have taken place. This is probably a number of years earlier than the limiting date for the occupation of the house. We can obtain in this manner data which show for instance that House A was built after 1720 and abandoned after 1740, that House B was built after 1800 and abandoned after 1820, and so on. While it is possible that House A was built at the same time as House B, in that event the time of building must have been later than 1800, the limiting date of House B. The unknown factor, in the case of a bark date, is the period of drift—the time lapse beginning with the death of the tree somewhere on a river bank and ending, after the tree was washed away by the river and carried to the sea, with its recovery and use by an Eskimo.

In the Kukulik Midden, a test cut revealed a succession of culture periods from bottom to top.[2] At least four semi-subterranean houses had been built one above the other. The following are end dates determined for utensils in House I, a recent house on the surface, known to have been abandoned in 1880, and House II, the lower walls and floor of which lay from three to five feet below the floor of House I:

House I: 1800, 1803, 1818, 1826, 1836, 1852, 1861.
House II: 1625, 1677, 1691 (bark).

[2] Geist, O. W., and F. G. Rainey, Archaeological excavations at Kukulik, Univ. of Alaska Misc. Pub., *II*, 59-62, 1936.

Since no construction logs were preserved from these houses the limiting dates, 1861 and 1691, concern only occupation. The platter which carries the date 1861 falls short of the known date of abandonment of the house by only 19 years, from which we may conclude that the margin of the platter reached approximately the outside of the log from which it was made, leaving a comparatively few years for drift. The date 1691 was obtained from a net shuttle from House II, the rounded outer surface of which is obviously the periphery of a log. We know from this that House II was abandoned some time after 1691—by inference, early in the 18th century, or approximately 150 years before the abandonment of House I.

The bark dates of ten construction logs used in five of the houses on the top of the midden, all abandoned in 1880, are as follows: 1813, 1819, 1830, 1838, 1846, 1860, 1860, 1866, and 1868.

At Point Hope, on the Arctic Ocean, the following dates were obtained: from a completely buried house structure into which native women were digging for ivory and fuel—1774, 1776, 1789, 1803, and 1820; and from another buried house a few yards away—1756, 1791, 1804, 1808, and 1815. All are bark dates from wall or roof logs, or hewn plank flooring.

In the foregoing groups of dates we have evidence that the last construction at Kukulik, on the shores of Bering Sea, took place approximately fifty years later than at the buried Point Hope village, a conclusion which is not easily established by comparing the artifacts of two abandoned villages of rather different cultural tradition.

A number of samples of driftwood were collected from various points during 1939 with the object of determining the origin of driftwood and the average time lapse between the death of the tree and its deposition on a sea shore. We are concerned in the present connection only with the latter problem. The following are all bark dates:

Reindeer Corral, Point Hope: 1867, 1878, 1881, 1882, 1911, 1918, 1918, 1921, 1923, 1929.

King Island, Bering Sea: 1838, 1862, 1872, 1877, 1893, 1897, 1902, 1903, 1917, 1918, 1921.

Little Diomede Island, Bering Strait: 1826, 1914, 1935.

The reindeer corral at Point Hope was constructed about 1930, and has been reinforced from time to time during the past decade. Six out of ten of these dates fall within the twenty year period immediately preceding the construction of the corral. The samples from King Island and Little and Diomede Island are all borings of house supports and rack frames, many of which must have been standing for a number of years, and though it is impossible to determine when any of these logs arrived at the islands, it is worthy of note that if we were to accept the latest date in any group as a time limit (as for the occupation of an abandoned village) we should closely approximate the actual date.

During 1940 attention was given to tracing driftwood to its place of origin, a study which involves making extensive collections of living tree samples over a wide area. In the course of a trip down the Kobuk River to Kotzebue Sound, up the Noatak River, and across the Seward Peninsula, a number of inland Eskimo sites were discovered within the timbered area, and in several cases tests were made to determine the degree to which tree-rings could be employed in more nearly the way in which they are connected with archaeology in the Southwestern States. Crossdating proved to be good in nearly every case near the limits of tree growth along the lower rivers, and in structures such as tepee-style graves the record in practically every log and pole was easily identified with that in living trees. From this it appears that any site along the lower rivers flowing into Kotzebue Sound and Norton

Bay will, if it contains even a small amount of wood, prove datable to the exact year of construction. It is to the extensive, well-preserved sites of the coast Eskimo, however, that we must look for a continuous, long chonology in which it will be possible to place many a house and village site specifically, and culture phase limits in a general way.

TREE-RING DATES FROM A MORMON CHURCH

FREDERICK H. SCANTLING

In August, 1939, four v-cuts were taken from logs in an old Mormon Church, which was located about a mile below the Arizona State Museum Archaeological Camp on Forestdale Creek. These four specimens gave dates as follows: 1781-1879, 1806-1879, 1762-1880, and 1787-1881. The last date in each set is the outside date. The record in these specimens was much more complacent than that of increment borings from modern trees growing high on the nearby slopes. Thus the trees used to build the church were probably cut from the floor of the valley or the lower slopes of the bordering hills. Type years in the sequence are, among others, 1857, 1859 and 1861; these rings are consistently small and effectively established the crossdating of the specimens.

After dating this group, the historical records were examined. The following is an extract from a history of Mormon settlement in Arizona giving the major events in the settlement of Forestdale.

"The Forestdale valley was found by Oscar Cluff while hunting in the fall of 1877 .... The settlement was started February 18, 1878 and by September was a prosperous community. In 1879 two of the missionaries made the mistake of allowing Indian families to come into the valley to plant their crops. It began to be rumored then that this land was a part of the reservation. The white population, therefore, drifted away and by 1880 the last had gone. In 1881 rumors began to be circulated that Forestdale was not on the reservation after all, so Forestdale was resettled and a new ward was established, with twenty families moving in. During the summer of 1882 there was more trouble with the Indians and their rights to the land and crops. This time President Smith advised the settlers to look for other locations, as the ground was on the reservation. In December, 1882 the settlers were advised by the officer stationed at Fort Apache, Arizona that they would be given until spring to vacate. By the spring of 1883 then, Forestdale was deserted—houses, fences, corrals and all improvements left behind."[1]

It can be seen from the history that the range of dates for the settlement was 1878-1883. Any building which was done at Forestdale must of necessity have been done during this period. The tree-ring dates fall into the period 1879-1881. The church then was constructed during the middle of the occupation of the community of Forestdale.

NEW TREE-RING DATES FROM THE FORESTDALE VALLEY, EAST-CENTRAL ARIZONA

EMIL W. HAURY

During the summers of 1939 and 1940, the Department of Anthropology and the Arizona State Museum of the University of Arizona conducted archaeological studies[1] in the Forestdale Valley, situated in the northern part of the Fort Apache Indian Reservation. This valley was formed by Forestdale Creek which heads below the Mogollon Rim, flowing in a south-

[1] McClintock, James H., Mormon Settlement in Arizona, Phoenix, Arizona, 1921, pp. 171-173.

[1] With the aid of two grants from the American Philosophical Society of Philadelphia.

westerly direction where it soon empties into Carrizo Creek and eventually into Salt River. It is in the heart of the western yellow pine belt of Arizona and that portion of the valley where the present archaeological work was done has an elevation of 6,580 feet above sea level.

Two ruins were involved in the excavations. The first, a pithouse village of the seventh century (the Bear Ruin, Arizona P:16:1) shows a mixture of Anasazi and Mogollon culture characteristics. The second was a thirty-room stone pueblo (Arizona P:16:2) of early eleventh century times.

In the Bear Ruin fourteen domestic buildings and one large kiva were excavated. These ranged in depth from 0.5 to 2.0 meters and showed a variety of treatments in so far as structural details were concerned. The four-post roof plan, bench, deflector-ventilator complex, central hearth and bins would identify these rooms with those of the Anasazi area. On the other hand the long side entrance, the hearth type consisting of a floor excavation without lining or copying, and the lack of stone construction and floor ridges, suggest an architectural affinity with the Mogollon culture. Shapes of houses were both rectangular and round, and there appears to be relatively little cultural significance in these variations. The kiva, a large structure with a maximum diameter of 15.3 meters, was equipped with a bench, a large recess to the southeast, and four small directional recesses.

Although a number of these structures had been burned, datable charcoal in very limited amounts was found in only two: House 1 and the kiva. All specimens were badly shattered, and in no instance was the outer ring preserved to yield the true cutting date.

As will be seen in the following tabulation, none of the final rings on the specimens from the Bear Ruin were later than 667. These are judged to be somewhere near the true outside, (excepting specimen 15b) and consequently the number of rings which must be added to compensate for the loss is probably small. It is believed that 675 will represent the approximate date of cutting of these timbers.

Number	Ruin	Room	Outside dated ring	Inside dated ring	Radius, mm.	Species	Form of specimen	Estimated rings lost at outside	Number absent in series	Estimated bark date
15b	Ariz. P:16:1	1	636	580	45	W.Y.P.	chcl.	40±10	0	676±10
18	Ariz. P:16:1	1	667	586	65	W.Y.P.	chcl.	10± 2	1	677± 2
67	Ariz. P:16:1	kiva	667	611	28	W.Y.P.	chcl.	8± 2	0	675± 2
52	Ariz. P:16:2	1	1098	1050	35	W.Y.P.	chcl.	5± 3	0	1103± 3
54	Ariz. P:16:2	7	1095	1046	23	W.Y.P.	chcl.	5± 3	0	1100± 3
61	Ariz. P:16:2	7a	1107	1067	20	W.Y.P.	chcl.	10± 5	0	1117± 5
55	Ariz. P:16:2	kiva 1	1117	1052	20	W.Y.P.	chcl.	3± 1	0	1120± 1
56	Ariz. P:16:2	kiva 1	1087	1056	12	W.Y.P.	chcl.	30± 5	0	1117± 5
57	Ariz. P:16:2	kiva 1	1113	1062	8	W.Y.P.	chcl.	5± 3	0	1118± 3
58	Ariz. P:16:2	kiva 1	1111	1062	20	W.Y.P.	chcl.	5± 4	0	1116± 4
59	Ariz. P:16:2	kiva 1	1117	1062	9	W.Y.P.	chcl.	3± 1	0	1120± 1
60	Ariz. P:16:2	kiva 1	1008	968	10	W.Y.P.	chcl.	?	0	1008+x
62	Ariz. P:16:2	kiva 1	1070	1016	15	W.Y.P.	chcl.	40±30	0	1110±30
68	Ariz. P:16:2	kiva 1	1121	1085	25	W.Y.P.	chcl.	2± 1	0	1123± 1
69	Ariz. P:16:2	kiva 1	1083	1048	35	W.Y.P.	chcl.	25±20	0	1118±20
66	Ariz. P:16:2	kiva 2	1108	1063	20	W.Y.P.	chcl.	5± 2	0	1113± 2

The Bear Ruin may be equated with the end of the Basketmaker III period of the Anasazi. This contemporaneity is further borne out by Basketmaker III pottery types which reached the village as trade pieces. Specifically, these were Lino Grey and White Mound Black-on-white. Ceramical-

ly, this village was closely aligned with Mogollon culture, there being present as indigenous types: Alma Plain, Forestdale Red (a derivative of San Francisco Red) and Forestdale Smudged, a thin, highly polished and smudged ware which appears to be a contribution of the local potters to the ceramic technology of the Southwest.

As far as is known, this village is the first one excavated to date in which smudged pottery occurred in any appreciable amount (15%) during the seventh century. This type which has been found in small amounts in ruins of the same time level,[2] is almost certainly attributable to the Forestdale Area source. Another type of pottery which shows the blending of the two fundamental cultures concerned was Forestdale Plain, a hybridization of Alma Plain and Lino Grey, paralleling in a way the mixed character of the architecture.

An interesting detail, in so far as pottery is concerned, was the absence of local painted ware. Apparently the emphasis was on the development of the smudging technique, and the painted pottery of the Mogollon, Hohokam, and Anasazi which reached the village did not stimulate local production.

In the pueblo, situated a few hundred meters southwest of the pithouse village, approximately a third of the rooms were cleared, together with an associated Great Kiva measuring over 19 meters in diameter and a poorly preserved small kiva. Culturally, this pueblo may be placed as early Pueblo III and ancestral to several large pueblos in the valley which represent the full Pueblo III and Pueblo IV periods.

Once again the charcoal material from the pueblo and Great Kiva was badly shattered, and in no cases could the cutting dates be determined. The tabulation reveals that there were no dates later than 1121 and that the dates cluster in the early 1100's. Judging from the amount of remodeling in the building itself, the founding of the structure must be placed somewhere in the eleventh century and the end of its existence may be assigned to the early part of the twelfth century.

The most noteworthy architectural feature is the Great Kiva, entered by means of a long and wide stairway. The tree-ring dates, although somewhat unsatisfactory, would show construction early in the twelfth century. This makes the building contemporary with the Great Kivas of Chaco Canyon and probably those near Zuni excavated by Roberts.[3] A local development rather than direct diffusion from the Chaco Canyon area is implied by differences in detail, especially since the large kiva in the Bear Ruin which is more than three centuries older would appear to serve as a prototype.

These results from the Forestdale Valley are, it is hoped, only the beginning of a long chronology based on tree-rings which will eventually accrue from work there. The area is ideally situated with respect to the necessary tree-ring materials; and culturally, the region provides what appears to be an unbroken sequence of occupation from the seventh to the end of the fourteenth centuries, not counting the more recent Apache remains which are also available. The research program includes a complete survey of all cultural resources of the valley.

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[2] Morris, E. H., The beginning of pottery making in the San Juan Area: unfired prototypes and the wares of the earliest ceramic period, Anthrop. Papers, Amer. Mus. Nat. Hist., *28, II*, 186, 1927.
Roberts, F. H. H. Jr., Shabik'eschee Village: a late Basket Maker site in the Chaco Canyon, New Mexico, Smiths. Inst. Bur. Amer. Ethn. Bul. *92*, 108, 117-118, 1929.
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[3] Roberts, F. H. H. Jr., The village of the great kivas on the Zuni reservation, New Mexico, Smiths. Inst. Bur. Amer. Ethn. Bul. *111*, 1932.