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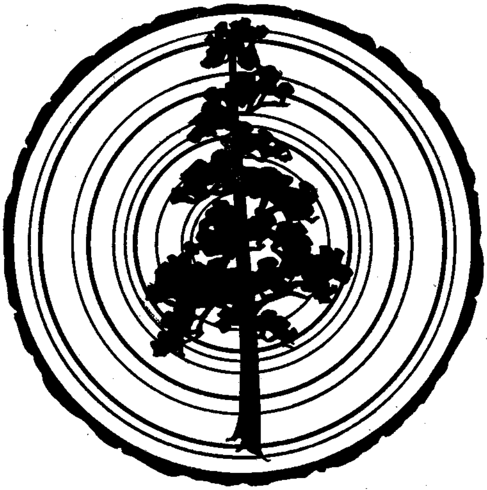

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BURIED WOOD FROM FAIRBANKS, ALASKA

By J. L. GIDDINGS, JR.

In the region between the Tanana and Yukon rivers in the interior of Alaska the valleys of the smaller streams contain heavy deposits of frozen silt. Locally termed "muck", these deposits contain not only the uniformly fine mica silt of the eroded schist bedrock, but also woody material, seams of peat, thin layers of volcanic ash, and extensive masses of ground ice. The bones of the extinct mammoth and super-bison are often found in the muck, as well as those of moose, caribou, wolf and other species of animals represented in the present day fauna.

With the possible exception of two species, all of the plant remains which have been identified, both large and microscopic, belong to living genera.(1) The larger plants, many of which have been well preserved through continuous freezing, are identical in form and distribution with those of the modern surface growth. The trees buried in the muck are alder, several varieties of willow, cottonwood, birch and white spruce.

In preparing the gold-bearing creek gravels for dredging, the overburden of muck is removed by hydraulic methods. During the past ten years several creeks of the Fairbanks region have been stripped of muck in wide cuts extending several miles along the stream course. At the mouth of west-flowing Engineer Creek, a tributary of Goldstream, ten miles north of Fairbanks, the muck varies in depth from ninety or a hundred feet on the slope facing southward to thirty feet near the present bed of the stream. During 1936 and 1937 this muck was stripped away to the top of gravel over an area approximately a mile long and a thousand feet wide. While no regular stratification exists, certain beds of peat can be traced for considerable distance in the cross-section afforded by a bank of the cut. Apparently, the separate flows of muck which covered these beds were only partial advances from higher slopes, for the peat beds converge downstream and inward towards the present course of Engineer Creek.

At different levels in various parts of the area the hydraulic operations exposed patches of old forest growth, the roots of which were in place in peaty soil. In more than one case a stand of spruce was found to have grown directly over an older one which had been buried. The oldest stand grew in a stratum of peat from one to three feet deep lying on top of gravel near the mouth of the cut. The valley at this point appears to have been much wider and more level across the trough than it is at present. Stumps of these oldest trees showed up in three separate patches of considerable extent. Some had lived over two hundred years without attaining much size. The stumps of the trees had been covered by several feet of silt, then by a thick deposit of debris consisting of sticks, logs, roots and leaves cemented by silt. Above this had grown more peat, and trees, which were in turn covered by silt.

From May to October of 1937 I collected sections of spruce stumps and logs as they appeared during the course of stripping operations at the mouth of Engineer Creek. Sections of the oldest trees cracked badly upon exposure to the air, but showed little rot. Most of those from a certain deposit impregnated with sulphur were badly rotted in the sap-

(1) R. W. Chaney and H. L. Mason, 1937. A Pleistocene Flora from Fairbanks, Alaska. Am. Museum Novitate No. 887.
J. B. Mertie, Jr., 1937. The Yukon-Tanana Region. U. S. G. S. Bulletin No. 872, pp. 188-193.

wood, while others from the higher levels differed from standing dead wood only in color. The greatest number of these sections were taken from material still partly frozen into the muck, and notes were kept on their location. Of the sections collected, many give complacent or distorted records. A large proportion of them, however, can be cross-dated without difficulty.

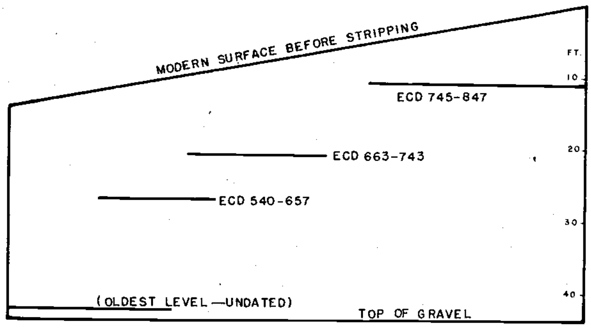

Fig. 1

Figure 1 shows in diagrammatic cross-section four distinct levels at which spruce trees grew in a limited area near the Goldstream Camp. Trees on the upper three levels grew during a period of 307 years, as determined by cross-dating. Included in this period of time is the deposition of from 15 to 20 feet of muck. At each of the three levels tree stumps were found with their roots in the peaty soil in which they grew. The dates assigned to these trees work forward in time from an arbitrary zero date.(2) (ECD stands for Engineer Creek Dating, following the method of identifying such chronologies in use at the University of Arizona Tree-Ring Laboratory.) The following list of trees by collection numbers, giving inclusive dates of growth and the age of each tree, explains in detail the tree growth represented in the diagram. The list is arranged in the order in which the trees died, for the purpose of grouping dates in which a muck flow probably started.

No.	Span(ECD)	Age
E-6	550-655	105
E-41	552-656	104
E-20	602-656	54
E-24	563-656	93
E-19	540-657	117
E-31	586-657	71
	———	
E-128	610-701	91
E-18	541-705	164
E-51	579-708	129
E-25	603-715	112
E-44	569-718	149
E-32	601-720	119
E-8	681-732	51
E-15	649-733	84
E-5	623-735	112
E-14	677-736	59
E-73	671-737	66
	———	
E-43	670-741	71
E-4	598-742	144
E-26	575-742	167
E-27	562-743	181
E-74	650-743	93
	———	
E-28	663-753	90
E-82	677-757	80
E-30	587-776	189
36-7	637-788	151
E-84	711-793	82
E-91	746-815	69
F-3	755-823	68
E-54	749-825	76
	———	
E-103	745-845	100
E-55	746-845	99
E-47	745-846	101
E-120	751-846	95
F-2	755-847	92
E-65	757-847	90

(2) The final dates of specimens here quoted are thought to be a few hundred years in the past, but the exact connection of these floating chronologies to known dates is not yet fully established.

Trees listed here which do not fall within the time limits of any of the three levels of Figure 1 were collected from debris channels nearby. These trees had obviously been uprooted and brought together by water. They had lodged either in frost cracks or in the bed of a stream which had cut a temporary channel into the muck, and had been afterwards covered and permanently frozen.

It is to be noted that at each level shown in the diagram a number of trees died within the three years preceding the terminal year. No trees were found to have grown at any one level after the terminal year for that level. Since the middle level overlaps the lower it is to be concluded that about six feet of muck was deposited between ECD 658 and 663. Similarly a thick layer of muck may have been deposited in ECD 743. The third level is not definitely known to have overlapped the middle level, however, and trees may simply have begun to grow after ECD 745, higher on a slope which was already established but unforested.

Figure 2 shows part of the buried forest at the middle level. At the time the photograph was taken the streams from hydraulic nozzles

Fig. 2. Buried Forest partly exposed by hydraulic operations.

were beginning to tear apart the peat bed in which the trees were rooted. Patches of the same spruce stands were found in widely separated parts of the cut, and will undoubtedly continue to be exposed in the process of future muck stripping.

The association of Pleistocene bones with comparatively modern trees in the muck will perhaps be accounted for when it is determined what factors caused the silt partly to thaw and follow the slopes in disorderly advances. The continuation of tree-ring study in Alaska will cast light on this subject as well as to afford a record of northern climate in past ages.

SOUTHWESTERN DATED RUINS: III(1)

By JOHN C. McGREGOR

Site No.	Name	Section	Cultural Stage	No. of Specimens	Range of Dates
N.A.2637	Calamity Cave	Nokai Can.	Pueblo III	1	1275
N.A.2507	Swallows Nest	Tsegi Canyon	Pueblo III	1	1249
N.A.2519	Kiet Siel*	Tsegi Canyon	Pueblo III	30	1116+x-1248±2
N.A.2521	Turkey House	Tsegi Canyon	Pueblo II-III	1	980±6
N.A.2536	Twin Caves	Tsegi Canyon	Pueblo III	17	1110+x-1280±2
N.A.2542	Pithouse	Tsegi Canyon	Pueblo II	1	1018
N.A.2543	Ladder House	Long Canyon	Pueblo II?	2	1064±5-1067±10
N.A.2630	Ken-a Ki	Dogozshibito	Pueblo II-III	2	1224-1230±3
N.A.2531	Bat Woman	Dogozshibito	Pueblo III	2	1275
N.A.2530	Loloma Ki	Dogozshibito	Pueblo III	1	1278
N.A.2606	Unnamed Site	Dogozshibito	Pueblo III	1	1275
N.A.2515	Betatakin*	Betatakin Can.	Pueblo III	1	1267
N.A.2185	White House*	Canyon de Chelly	Pueblo III	1	1075
N.A. 405	Wupatki*	Wupatki N. Mon.	Pueblo III	49	1084+-1197
N.A. 538	Nalakihu*	Wupatki Nat. Mon.	Pueblo III	8	1183
N.A.2800	(Pithouse)*	Baker Ranch	Pueblo I	4	680+x-792±
N.A.2551	(Pithouse)*	Baker Ranch	Pueblo I	1	685+x
N.A.2798	(Pithouse)*	Baker Ranch	Pueblo I	12	710+x-927+
N.A.1925 B	(Pithouse)*	Bonito Terrace	Pueblo I	2	840-855
N.A.1920 B	(Pithouse)*	Bonito Terrace	Pueblo I	1	860
N.A.2002 A	(Pithouse)*	Medicine Valley	Pueblo II	18	914+x-1115
N.A.1238	(Pithouse)*	Medicine Valley	Pueblo II	5	926-1066
N.A. 862	(Pithouse)*	Medicine Valley	Pueblo II	21	904+x-1061
N.A.1570	(Pithouse)*	Medicine Valley	Pueblo II	3	941-1046
N.A. 863	Medicine Cave	Medicine Valley	Pueblo II	1	1025
N.A.2001	(Pithouse)*	Medicine Valley	Pueblo II	6	825+x-965
N.A.1625 B	(Pithouse)*	Medicine Valley	Pueblo II	2	879+x-927
N.A.1680	(Pithouse)*	Medicine Valley	Pueblo II	–	880+x-909±10
N.A.1625 C	(Pithouse)*	Medicine Valley	Pueblo II	7	777+x-947±10
N.A.1244 B	(Pithouse)	Medicine Valley	Pueblo II	2	817-821
N.A.1814 A	(Pithouse)	4th Terrace	Pueblo II	3	907-927
N.A. 192 B	(Pithouse)	Deadman's Flat	Pueblo II	2	910-924
N.A. 408	(Pithouse)*	Jack Smith Tank	Pueblo II	6	824+x-908+x
N.A. 534	Small Site	Winona	Pueblo III	1	1246
N.A.2134 A	Winona Village	Winona	Pueblo II-III	9	1100-1131
N.A.1531	Elden Pithouse*	Flagstaff	Pueblo I	3	708+x-855
N.A. 322	Cliff Dwellings	Walnut Canyon	Pueblo II	4	888-1094

(1) (Dated for the Museum of Northern Arizona. A number of these early pieces were in relatively moist ground and had lost their sapwood by decay; hence the "+x" may be large. For further discussion see "Dating the Eruption of Sunset Crater, Arizona", by John C. McGregor in American Antiquity, Vol. II, No. 1, pp. 15-26; July, 1936. A.E.D.)

* See also other installments of this series.

TREE-RING DATING: FACTORS PERTAINING TO ACCURACY

By WALDO S. GLOCK

Since unerring accuracy is the prime desideratum in dating by tree-rings of ancient Indian dwellings and of climatic changes indicated in the rings, it may be well to summarize briefly the pertinent observations of the last few years. Much of the information here given came from a forest-border ponderosa pine (OL-12) which was almost completely dissected. In particular, statements concerning locally present and missing rings, doubles, and branches depend largely upon that tree.

The sequence of rings in OL-12 was found more likely to be complete in mid-tree or slightly above. In other words, absences of rings were more common in the upper and lower parts of the trunk. Hence specimens from pine beams to be used for dating purposes are best taken, if possible, at what was once mid-tree and should include as much of the trunk as practicable because in this way the chances of securing a complete sequence are at a maximum. An important chronology should not depend solely on a single radius of a specimen; all available material must be employed.

Since many trees in a single locality at the forest border tend to drop the same rings or parts of them, great care must be taken to see that no rings are left out of a local master sequence. Living trees, of course, do not present a serious problem. A collection of them should include a few trees of less age and a few of more uniform growth than a majority of the collection because these two very probably contain a complete sequence of rings. The matter is somewhat different among ancient timbers which were gathered by Indians for construction purposes. A collection of such timbers is limited not only in the number of specimens but also in the amount of material per specimen. Therefore the possible limitations of the material from ancient ruins should be clearly recognized and ring sequences should be duplicated many times in order to eliminate, in so far as possible, all chance of missing rings.

In OL-12 a ring, double at a given place, was not necessarily double throughout the entire trunk. The amount of doubling increased upward in the tree and toward its center. Also, the percentage of doubling per ring increased upward. Hence, doubling is not a stable character even within a single tree. The local occurrence of doubles within a tree necessitates extreme care in making climatic inferences dependent upon these doubles. For instance, a single radius taken from one part of the trunk may show that a certain set of rings is double whereas another radius taken from a different part of the trunk may show that a different set of rings is double. Resulting climatic interpretations, it is obvious, will be seriously open to question until exact information on all aspects of the origin of doubles is obtained.

Sequences taken from a branch are more or less aberrant with respect to the record in the main stem. Therefore, an admixture of branches in a collection under study would introduce material partly out of harmony with the typical record both chronologically and ecologically. The more a single tree contributes to a collection, the more restricted are the possible inferences and the less is the certainty that its record is typical.

The tree OL-12 was dissected chiefly for the purpose of establishing the fact that the ring record in one part of the trunk is essentially duplicated in all other parts. Uniformity within the individual trunk was revealed beyond all doubt, and any one radius is highly representative of all radii. However, more than one radius from a beam is advantageous for two reasons. (1) As previously stated, the possession of a completely accurate sequence demands that as much as possible of a beam be available for study. Different parts of a tree, it is to be remembered, have different values in the perfection of their records. (2) For precision work the measurement of four to six radii taken around the circuit or vertically in the trunk gives a more accurate determination of the relative volume of wood added each year than that given by one radius only.

It should be recognized clearly that uniformity, signifying a constancy in the relative thickness of rings, is to a certain extent a variable feature both within a single tree and also within a group of trees. In other words, a certain amount of variation, or nonuniformity, is present and is to be expected in specimens of the most superb dating qualities.

The foregoing observations bear directly upon the questions, What constitutes accuracy of dating, or cross-dating, and how much leeway, or divergence from an absolutely perfect correspondence in ring thickness, does accurate dating entail? Obviously the answer is not far to seek. The amount of latitude permissible in behalf of wholly accurate dating should equal the variation characteristic of the individual trunk record plus the variation inherent in the combined gross record among two or more trees where, and only where, all the trees concerned in the dating grew under the same ecologic conditions. Acceptable divergence from exact correspondence between different ring records should not exceed that incorporated naturally within the trees and should be determined as little as possible by the individual opinion of any one student. From the practical standpoint the amount of latitude permissible must be gained by experience with what may be called the difference between mathematical and biological exactness.

An appreciation of the expected variability in a ring structure which has been built under the influence of a complex of factors serves to clarify the nature of a standard sequence or master chart. The standard possesses not only the diagnostic rings common to a certain group of trees but also those rings **ordinarily** variable within the group. Therefore, since the standard bears only those features, fixed and typically variable, common to a locality, there is undoubtedly no single tree, or beam, whose sequence of ring thicknesses correlates 100 per cent with the standard.

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