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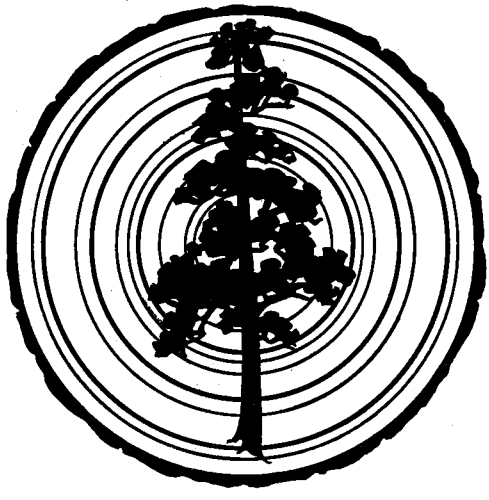

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THE TREE-RING BULLETIN

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EARLY HEIGHT GROWTH IN DOUGLAS FIR

C. W. Ferguson, Jr.*

The age of dendrochronologic trees, as distinct from the ring count on increment cores, has occasionally been used in climatic studies at the Tree-Ring Laboratory. To obtain the total age, a conservatively small number of years of estimated height growth has usually been added to the length of the ring record at the sampling level. In order to provide a better basis for such estimates, a study was made of a primary species, Rocky Mountain Douglas fir (*Pseudotsuga taxifolia*). Core samples of young trees, ranging from two to twelve inches in diameter at breast height and from fifteen to fifty feet in height, were taken during the summer of 1949 near Divide, Montana, at Mesa Verde National Park, Colorado, and at three locations in the Santa Catalina Mountains, near Tucson, Arizona.**

Site 1. Divide, Montana. Dry, rocky, south and southwest slopes of hillside north of the road and east of the bridge about one mile west of Highway 91; elevation 5500'; reproduction occurs in groups in an old cut-over area; samples were taken from isolated trees on the outer fringe of the denser groups; associated species include big sagebrush (*Artemesia tridentata*) and mountain mahogany (*Cercocarpus* sp.).

Site 2. Mesa Verde National Park, Colorado. Relatively moist and shaded creek bed of Spruce Tree Canyon just below Spruce Tree House; elevation 6800'; all trees within a few feet (or root distance) of the stream bed.

Site 3. Santa Catalina Mountains, Arizona. Dry site near head of Bear Canyon about one-quarter mile above Hitchcock Tree; elevation 6500; open Douglas fir and ponderosa pine (*Pinus ponderosa*) stands, the former more common on the north slopes; soil a decomposed granitic type; associated vegetation primarily oak; all sampled trees on a north slope, some very near the ridge top.

Site 4. Santa Catalina Mountains, Arizona. Canyon bottom near Hitchcock Tree picnic area; elevation 6000'; relatively shady and moist; very slight north slope just above the stream bed; most of the specimen trees were overtopped by other trees.

Site 5. Santa Catalina Mountains, Arizona. One mile northwest of the Mount Lemmon Lodge; 100 yards above the junction of the Red Ridge Trail with an access road; elevation 8500'; moist 30 to 40 degree north slope in a semi-open, cut-over area; granitic soil; dominant vegetation Douglas fir and ponderosa pine; specimen trees were in thickets or overtopped.

Cores included in each of the five groups were taken at three levels in the stem. The lowest level, called A, was at either six inches or one foot

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**The author is indebted to Edmund Schulman for suggestion of the problem and for guidance in the work.

above the ground at Divide and Mesa Verde and at six inches in the Santa Catalina Mountains; level B was at 33½ inches (two lengths of the increment borer, a convenient field measure) above the first; and level C an additional 33½ inches above the second.

In the three Santa Catalina Mountain collections the pith was present in all cores, but in the Divide and Mesa Verde collections it was necessary in some instances to extrapolate the series to derive the pith dates. By extension of the circumference of the innermost ring, which in most instances was within three years of the pith, and in the light of the expected average ring-widths for the years in question as given by the master chronology for the area,[1] it was possible to arrive at a substantially exact estimate of the pith date. Relatively microscopic rings, for 1902 and 1904, occurred very near the pith in the Mesa Verde cores.

The data in Table 1 show that the average growth rate between levels A and B was approximately half that of the growth between the upper levels B and C. This initial suppression may be extreme in some cases. The maximum suppression recorded in this study was that of tree No. 13, a low latitude, low elevation, dry site individual that took twenty-four years to grow the first 33½ inches above level A and fifteen to grow the second. This tree, though on an unfavorable site, was not, however, growing under extreme conditions for this species. A six-foot Douglas fir at Mesa Verde proved to be about 135 years old.[2] Others of even slower height growth have been sampled in recent field surveys, not yet published, of the Tree-Ring Laboratory. The most rapid growth noted in Table 1 was five years for the first growth interval and three years for the second, in two specimens, trees 24 and 19, both of which were growing under relatively favorable conditions. This wide range in rapidity of height growth may be due to a variety of unevaluated site conditions in addition to evident biotic and edaphic relationships.

It is probable that there is a corresponding variation in seedling growth below the height level A of the borings reported here. In nursery practice, most coniferous species are considered suitable for field planting when from four to ten inches in height. The age of Douglas fir seedlings used in replanting throughout the central and southern Rocky Mountain region is three or four years.[3] At the Savenac nursery of the Forest Service at Haugan, Montana, the approximate height for 2:1 Douglas fir (two years in the seed bed; one year in the transplant bed) is four inches and for 2:2 nursery stock it is six inches.[4] It is probable that the trees reported here had an age of at least four or five years, and perhaps much more, at the lowest level sampled.

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[1]Schulman, *Tree-Ring Bull.*, 12(3), 1946, pp. 18-24.
[2]*Op. cit.*, p. 24.
[3]Toumey, J. W. and C. F. Korstian, *Seeding and Planting in the Practice of Forestry*, 1943 pp. 431-2.
[4]Olson, D. S., Growing Trees for Forest Planting in Montana and Idaho, *U.S.D.A. Cir.* 120, Aug., 1930, p. 71.

Table 1. Height Growth in Rocky Mountain Douglas Fir

Tree No.	Estimated Height, feet	Average Ring-Width at Level A, mm.	Pith Dates at Sampled Levels A	B	C	Height Growth, years A-B	B-C	A-C
			Site 1. Divide, Montana					
6	15	.98	1886*	1909*	1916*	23	7	30
7	25	1.57	1878*	1898*	1910	20	12	32
8	30	2.00	1906	1912	1915	6	3	9
9	35	2.61	1900*	1909	1911*	9	3	12
10	15	1.81	1901*	1913*	1920	12	7	19
Mean		1.79				14.0	6.4	20.4
			Site 2. Mesa Verde National Park, Colorado					
1	30	1.49	1888*	1896	1906*	8	10	18
2	30	1.34	1896*	1907*	1912	11	5	16
3	40	1.59	1888*	1903*	1910*	15	7	22
4	30	1.16	1886	1896*	1906	10	10	20
5	35	1.05	1890*	1903*	1908	13	5	18
Mean		1.33				11.4	7.4	18.8
			Site 3. Santa Catalina Mountains, Arizona					
11	25	.90	1888	1905	1910	17	5	22
12	15	1.03	1912	1918	1927	6	9	15
13	35	.62	1862	1886	1901	24	15	39
14	20	.67	1891	1912	1915	21	3	24
15	20	1.18	1909	1920	1927	11	7	18
16	20	1.47	1913	1920	1926	7	6	13
Mean		.98				14.3	7.5	21.8
			Site 4. Santa Catalina Mountains, Arizona					
17	25	1.15	1909	1917	1920	8	3	11
18	15	.79	1915	1922	1928	7	6	13
19	50	2.63	1909	1914	1917	5	3	8
20	30	1.78	1909	1918	1923	9	5	14
21	25	1.27	1908	1917	1922	9	5	14
22	25	1.38	1912	1920	1923	8	3	11
Mean		1.50				7.7	4.2	11.8
			Site 5. Santa Catalina Mountains, Arizona					
23	20	1.81	1923	1932	1936	9	4	13
24	30	2.96	1920	1925	1928	5	3	8
25	25	2.92	1926	1933	1936	7	3	10
26	20	1.57	1926	1935	1938	9	3	12
27	20	1.61	1926	1936	1940	10	4	14
28	15	1.90	1930	1940	1942	10	2	12
Mean		2.13				8.3	3.2	11.5

*Core did not contain pith, the date shown being an extrapolation (see text).

The data pertaining to height, ring-width at level A, and pith dates at level A suggest that there may be systematic differences in the age trends in growth among trees in different geographic regions.

The scope of the study was necessarily limited; with the acquisition of further data, it is likely that the differences in growth rate at various levels would be found to be much greater. However, the collections here reported seem to be characteristic of a very large number of sites throughout the Rocky Mountain region.

TREE-RING DATES FOR THE GALLINA AREA, NEW MEXICO

BRYANT BANNISTER*

The dated specimens reported in Table 1 are from four sites representing three localities in the Gallina area, north central New Mexico. All specimens were collected by Dr. Frank C. Hibben of the University of New Mexico. This area is drained by the Gallina River, the Rio Chama, and the Rio Grande and varies in altitude from 6500 to 8000 feet.

The original dating work on the Nogales Cliff House material was done by Frederick H. Scantling in November, 1939, and is reported by Hibben.[1] Dating of the Cuchillo House was done by Terah L. Smiley in early 1950. The opportunity to make use of this dated material is greatly appreciated. The Bg specimens were dated by the writer early in 1950.

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[1]Hibben, *American Antiquity* 14: 32-36, 1948.

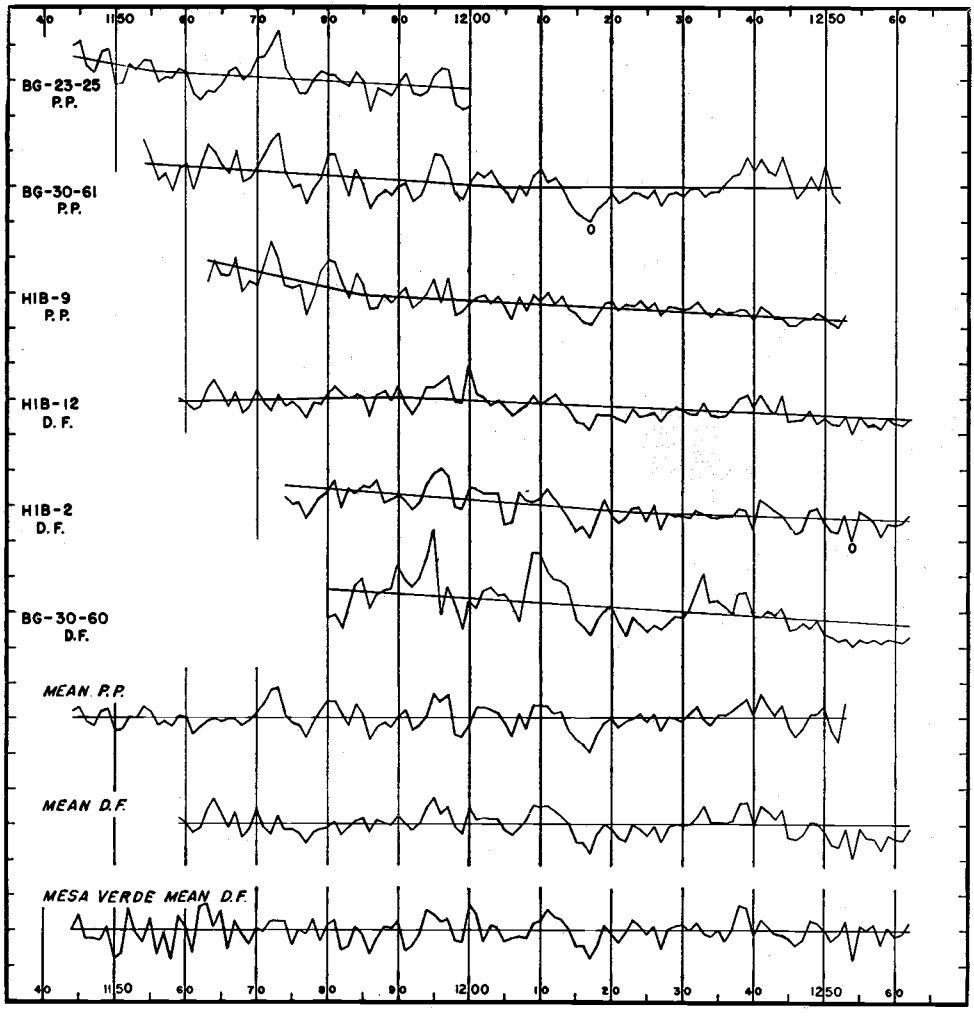


Figure 1. Measured ring-widths in dated beams from the Gallina area. Trend lines (by E.S.) are superposed on the growth curves; zeros below the curves indicate locally absent rings.

Table 1. Dated Specimens from the Gallina Area[1]

Specimen Number	Site	Form	Species	Mean Ring-Width, mm.	Plot Scale	Inner Ring, A.D.	Outer Ring, A.D.
Bg 23-25	Rattlesnake Point[2]	Ch. sec.	PP	.56	1	1143 p	1201 v
Bg 30-60	Llaves[3]	Wd. sec.	DF	1.05	2	1179 p	1266+vv
Bg 30-61	Llaves[3]	Wd. ⅛ s.	PP	1.14	2	1153 p	1255+vv
HIB - 2	Nogales Cliff Hse.[4]	Wd. ¼ s.	DF	.88	2	1168	1264 vv
HIB - 9	Cuchillo Hse.[5]	Ch. ¼ s.	PP	1.18	3	1163 p	1253 c
HIB -12	Nogales Cliff Hse.	Wd. sec.	DF	.38	1	1155 p	1267 v

[1]See *Tree-Ring Bulletin* 15 (4) for symbol code.
[2]Surface structure in T 26 N, R 1 E Sec. 15. Three Bg series specimens not plotted here have outside dates ranging from 1213vv to 1264+vv and represent two other Bg sites.
[3]A personal communication from Dr. Hibben gives the source of these specimens as a cliff house east of the postoffice at Llaves.
[4]Nogales Canyon. Four additional specimens from Nogales Cliff House have outside dates ranging from 1239 to 1266.
[5]Surface structure in Nogales Canyon. Five additional specimens from Cuchillo House have outside dates ranging from 1248vv to 1254c.

Table 2. Tree-Ring Indices for the Gallina Area:
Ring-Widths in Per Cent of the Growth Trend

A. Ponderosa Pine

A.D.	0	1	2	3	4	5	6	7	8	9
1140	.....	.....	.....	.....	119	130	87	77	117	124
1150	61	63	102	99	132	117	76	88	74	105
1160	103	55	75	92	99	89	97	94	78	92
1170	111	136	174	183	105	85	77	43	84	118
1180	145	144	105	75	137	108	37	71	83	69
1190	101	120	63	75	100	164	145	160	50	45
1200	77	126	126	120	111	83	47	108	69	134
1210	133	130	112	117	64	39	14	02	53	85
1220	98	72	89	97	109	85	108	59	99	99
1230	90	106	129	95	79	108	106	119	135	152
1240	106	169	133	106	134	74	45	87	109	110
1250	131	61	30	144	.....	.....	.....	.....	.....	.....

B. Douglas Fir

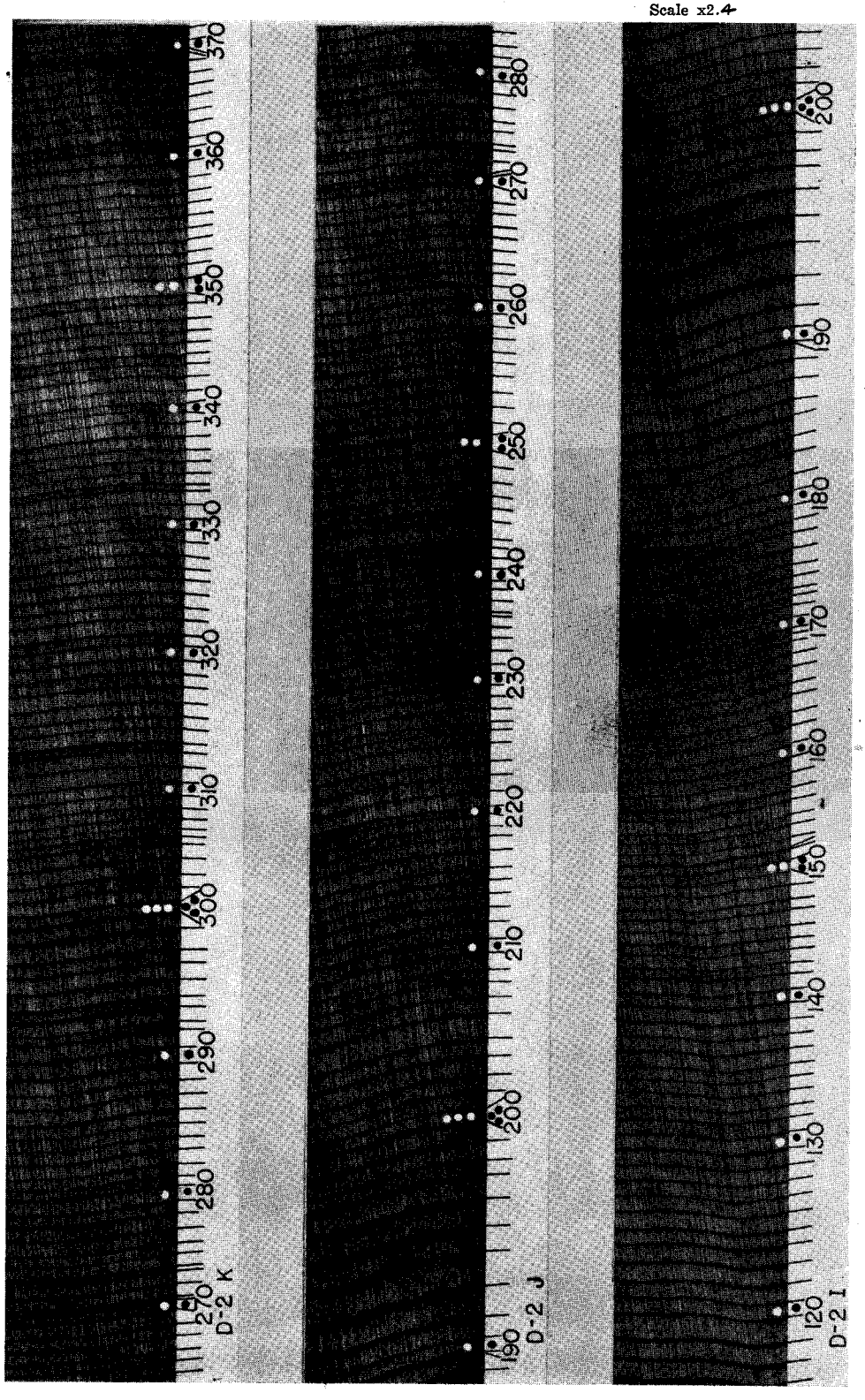
A.D.	0	1	2	3	4	5	6	7	8	9
1150	.....	.....	.....	.....	.....	.....	.....	.....	.....	116
1160	104	75	88	140	172	127	85	134	62	87
1170	140	91	70	122	82	82	74	44	75	85
1180	89	105	71	92	108	116	78	113	103	98
1190	125	101	80	101	146	175	127	148	91	71
1200	143	111	116	113	113	80	66	87	114	151
1210	145	148	136	120	101	45	44	17	72	99
1220	85	59	51	98	84	66	93	47	89	99
1230	93	99	120	151	104	103	102	109	156	161
1240	97	152	137	113	140	62	56	70	103	102
1250	78	42	34	83	02	90	61	58	25	70
1260	58	57	87	.....	.....	.....	.....	.....	.....	.....

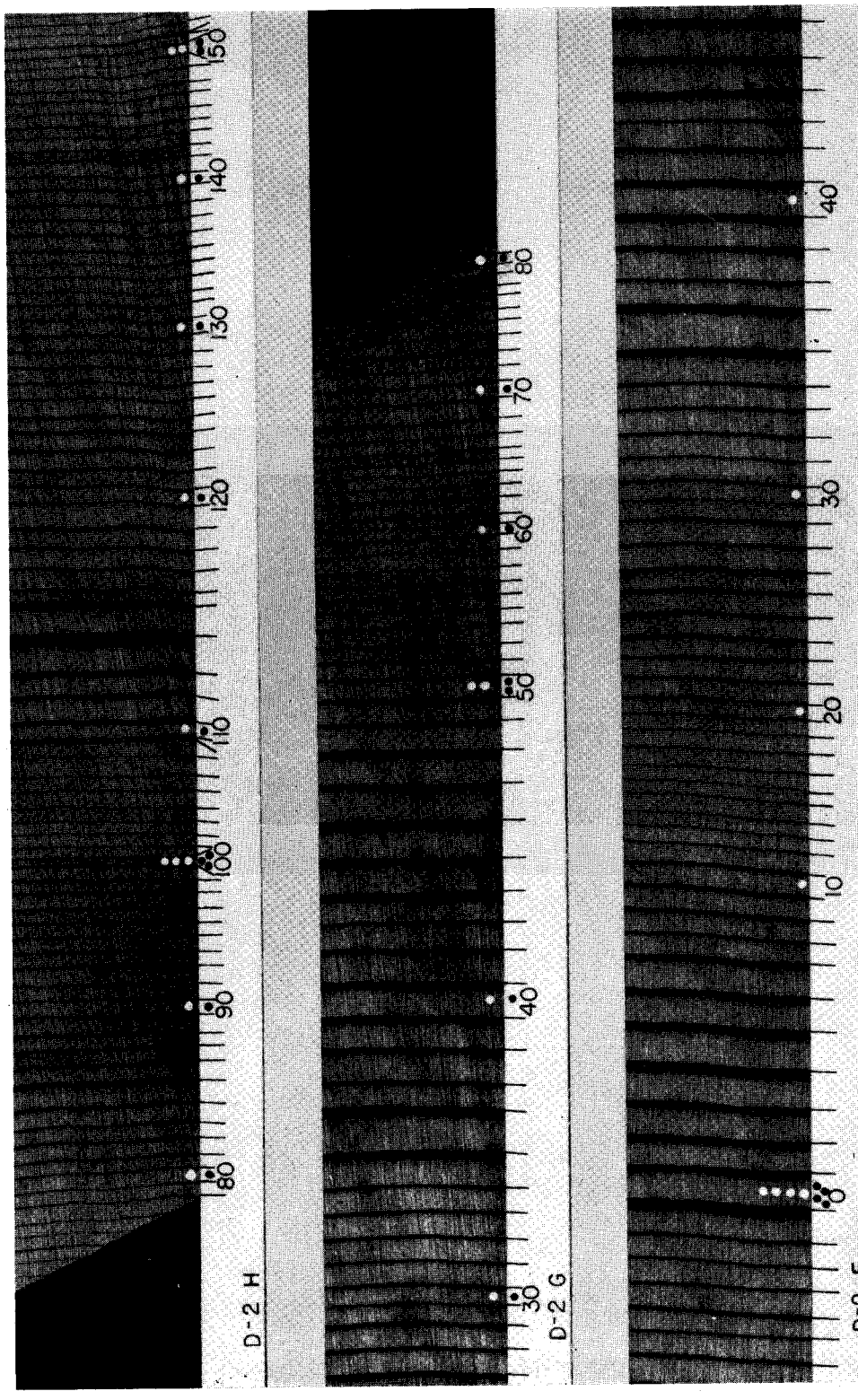
Measured growth series in Figure 1 show the ring chronologies in the three Gallina localities to be similar. Standardized means of the ponderosa pine and Douglas fir specimens were separately derived and are tabulated in Table 2. It is evident that the chronology is essentially the same in both species. The relation to the Mesa Verde Douglas fir index,[2] representing an area 120 miles to the northwest, is also illustrated in Figure 1.

[2]Schulman, *Tree-Ring Bulletin* 14: 6-7, 1947.

A SUPERIOR SEQUOIA RING RECORD. IV, 7 B.C.-A.D. 372

A. E. DOUGLASS

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D-2 G
D-2 F