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 Tucson, Arizona

## NOTE ON THE EARLY DURANGO COLLECTIONS

A. E. DOUGLASS

During 1938 to 1945 several hundred specimens from the Durango area were sent to me from the collections of E. H. Morris, I. F. Flora, and others. A considerable number were readily dated by comparisons with the long chronology already developed in northeastern Arizona. These gave definite dates to several pithouse ruins about 10 miles north of Durango. Among these was IGN 7:31, close to the Carnegie-Morris camp of 1939 with building dates in the 750's A. D. IGN 7:36 and 7:23 were in the same general area and time. The dating of these three was complicated by the use of immensely old scopulorum junipers showing in many fragments ring dates in the 200's A. D. Sites IGN 12:1 and others were in the same class. The largest single contributing ruin was IGN 7:101, Floor 1, which was dated near A. D. 320, with many fine Douglas fir specimens extending a chronology back to A. D. 176. Small specimens from the Fall Creek Caves were awaiting attention when increased research in climate, war-related, demanded full time.

By the beginning of 1948 it was evident that I could not hold these valuable specimens back from proper study, and the entire collection was handed over to Edmund Schulman, who is using them in developing long, strong, quantitative ring records.

The following references include photos of early Durango ring records: Tree-Ring Bulletin 8:14, 1941, and 9:21, 1943; Researches in Dendrochronology, Univ. Utah Bull. 37 (2), 1946, p. 11.

## EARLY CHRONOLOGIES IN THE SAN JUAN BASIN\*

EDMUND SCHULMAN

### COLLECTIONS AND DATING

Early in 1948 the entire set of dated specimens from northeastern Arizona<sup>1</sup> was minutely reviewed and mean standardized growth curves derived separately for Douglas fir and pinyon pine. Short individual ring series were not included, in general. All of the longer and most sensitive specimens from the Durango area in southwestern Colorado<sup>2</sup> were also measured, reduced to mean growth curves, and with the northeastern Arizona material are presented in full in Figure 1.

<sup>1</sup>A. E. Douglass, Tree-Ring Bulletin 2:29-34, 1936 and 6:39, 1940; Southwestern Photographic Ring Sequences, Amer. Documentation Inst. Doc. 1298, Washington, 1939.

<sup>2</sup>Douglass, Tree-Ring Bulletin 9:21, 1943 and 15:24, 1949.  
 E. W. Haury and I. F. Flora, Tree-Ring Bulletin 4 (1) : 7-8, 1937.

\*Fifth report on quantitative master chronologies in the Pueblo area. For previous reports see Tree-Ring Bulletin: 12 (3) and table in 14 (1) ; 14 (2) ; 14 (3) ; 15 (1/2).

In March, 1948 the main collection from Falls Creek Caves, near the Trimble Springs site IGN 7:101, was sent to the Laboratory through the courtesy of Earl H. Morris, Harold S. Gladwin, and Deric O'Bryan. It proved to contain a number of extraordinarily fine, though short, records in the 100's A. D. With the aid of the new material several specimens from 7:101, representing the previously undated Floors 2 and 3, were also found to carry good records in the 100's. All of these series have been included in the figure.

The apparently consistent early use of Douglas fir and later use of ponderosa pine at Durango, as shown in panel A of the figure, is largely, though perhaps not entirely, an accidental distribution dependent on the set of currently dated specimens and the location of the ruins from which they were derived. Specimens of ponderosa and pinyon pine, thus far undated, are present in the early collections at Durango.

Specimen data are summarized in Table 1†. The mean growth indices for northeastern Arizona are tabulated in Table 2; the Durango indices are not tabulated here, since it is expected that they will be extended in the near future.

#### THE EARLIEST CUTTING DATES IN THE SOUTHWEST

Construction dates thus far determined at Falls Creek Caves are roughly contemporaneous with DuPont Cave near Kanab, Utah, which was dated in 1939 at A.D. 217 as the earliest site<sup>3</sup>. In the newly dated collections, specimen 2H-30, a sensitive, open, wood series from the Falls Creek Caves, in Douglas fir, shows a complete outer ring at A.D. 203, and since well-preserved bark adheres to the outside, provides the earliest definitive cutting date in Southwestern archaeology‡. Specimen 2H-41 from the same site, a full section, was almost certainly cut at the same time or earlier.

Microscopic analysis of material at the outside of charcoal specimen II-1 from the 7:101 site showed it to be bark; between the bark and the datable sequence ending at A.D. 182 was a crowded set of eighteen rings within which some omitted rings may be suspected. The cutting date of this specimen is therefore given as A.D. 200+.

There is strong but not conclusive evidence that charcoal beam III-4 from the 7:101 site was cut shortly after the ring for A.D. 188 was complete. After the fragment with this number was dated, measured, and plotted in the diagram, several other fragments from Floor 3 were identified as from the same tree. All showed readable sequences out to the relatively large ring for A.D. 188, which was in all cases continuous on the outer surfaces. A thin film of macerated material adhering to the outside of the specimens was tentatively identified as inner bark but was nowhere present in sufficient thickness to make the identification conclusive.

†Specimens in Table 1a were dated by Douglass (Tree-Ring Bulletin 2:29-34, 1936 and unpublished notes) except for CK-331 (F. M. Hawley, Bulletin 3:21, 1937) and FR-20 (C. F. Miller, Jr., Bulletin 1:31, 1935). Of the specimens in Table 1b, the first eleven were dated by Schulman and the next five by Douglass; the remaining twelve were part of a very large body of material contributed by I. F. Flora, who had correctly dated numbers 91, 92, 135, 154, 160, 16A:1, and DPL-2, Douglass dating 104, 106, and 7:2, and Schulman 109 and 124. For the Falls Creek Caves, symbols ADE, AF, 2H, etc., represent various subdivisions of excavation; at 7:101, Floor 3, Beam 4, is designated by the symbol III-4, etc.

<sup>3</sup> Stallings, Tree-Ring Bulletin 8:3-6, 1941.

‡Presented at the Southwestern Archaeological Conference, Point of Pines, Arizona, Aug. 25, 1948.

That Floors 2 and 3 of the Trimble Springs ruins were contemporaneous with the principal dated horizon of the nearby Falls Creek Caves is at least suggested by the range of dates in Table 1.

#### CLIMATIC RELATIONS

To estimate the rainfall-index value in the early ring records from northeastern Arizona we may refer to the close relation between recorded October-June rainfall at Durango and tree growth at Mesa Verde<sup>4</sup>.

Only limited comparisons of the early northeastern Arizona series with the standard index for Mesa Verde may be made, for the former antedates almost all of the latter. A single but excellent Mesa Verde Douglas fir, MV-23, parallels the fairly well based record in this species in northeastern Arizona during the 500's and late 400's. Despite the inadequacy of one tree as the basis of a climatic index, correlation coefficients were found to be fairly high, as follows: 465-499—+0.68; 500-549—+0.51; 550-599—+0.58. These coefficients agree with the expectation that these two areas are essentially subject to the same fluctuations in winter precipitation; living trees indicate that occasional minor but real differences in chronology do exist, especially between Mesa Verde and the more westerly sites in northeastern Arizona. More detailed analysis of the climatic history in the indices of this report is reserved until the survey of Southwestern chronologies is complete.

Table 1a. Dated Specimens from Northeastern Arizona

Specimen No.	Site	Form <sup>1</sup>	Species <sup>2</sup>	Mean Ring-Width, mm. <sup>3</sup>	Plot Scale <sup>4</sup>	Inner Ring, A.D. <sup>5</sup>	Heart-wood Ends, A.D.	Outer Ring, A.D. <sup>6</sup>	
MLK-152 <sup>7</sup>	Obelisk Cave	sec.	DF	0.28	2	10 p	421	477 c	
M -143	Mummy Cave	v-cut	DF	0.26	2	91 p	289	358 b	
MLK-151	Obelisk Cave	v-cut	DF	0.75	1	233 p	416	479 v	
M -190	White House Ruin	v-cut	DF	0.46	1	238 p	475	496 v	
M -110	Mummy Cave	ch. sec.	DF	0.70	1	261 p	.....	348 b	
MLK-118	Broken Flute Cave <sup>8</sup>	½ sec.	DF	0.56	1	305 p	354	378 c	
MLK-280	Obelisk Cave <sup>9</sup>	v-cut	DF	0.64	1	317 p	441	480 c	
M -102	Mummy Cave	v-cut	DF	1.03	1	352 p	377	408 c	
M -142	Mummy Cave	v-cut	DF	1.21	½	354 p	402	433 v	
M -195	Mummy Cave	ch. fr.	DF	0.54	1	371	.....	436 vv	
M -101	Mummy Cave	v-cut	DF	1.19	½	378	.....	485 vv	
BE - 33	Mummy Cave	¼ sec.	DF	1.72	½	389 p	443	484 v	
MLK-174	Broken Flute Cave	fr.	DF	0.34	2	405	.....	513 vv	
M -129	Mummy Cave	½ sec.	DF	0.82	½	409 p	.....	486 vv	
MLK-211	Cave 6	¼ sec.	DF	0.45	1	419 p	.....	553 vv	
MLK- 35	Cave 2	ch. sec.	DF	0.50	1	517 p	.....	663 vv	
MLK-127	Broken Flute Cave	v-cut	DF	1.28	½	521 p	579	623 c	
MLK-179	Broken Flute Cave	sq. cut	DF	0.66	1	535 p	584	623 c	
M -179	Del Muerto Cave 1	fr.	DF	0.77	1	590 p	652	702+c	
M -163	Mummy Cave	v-cut	DF	1.07	½	622 p	.....	666 c	
BE - 32	Mummy Cave	v-cut	DF	0.66	1	715 p	758	804 v	
M - 57	Sliding Ruin	sq. cut	DF	0.47	1	768 p	.....	834 vv	
M -155	Mummy Cave	sec.	PP	1.37	½	663 p	.....	702 c	
MLK-153	Obelisk Cave	sec.	PNN	0.38	2	149 p	.....	486 c	
M -159	Mummy Cave	core	PNN	0.40	2	191	.....	367 c	
MLK-110	Broken Flute Cave	sq. cut	PNN	0.35	2	197 p	.....	472 v	
MLK-154	Obelisk Cave	v-cut	PNN	0.40	2	293 p	.....	488 c	
MLK-226	Broken Flute Cave	sec.	PNN	0.68	1	380 p	.....	505 <sup>m</sup> c	
MLK-145	Broken Flute Cave	sq. cut	PNN	0.45	2	418 p	.....	618 v	
MLK-109	Broken Flute Cave	½ sec.	PNN	0.42	2	457 p	.....	601 c	
MLK- 21	Cave 2	v-cut	PNN	0.31	2	476 p	.....	669 c	
MLK- 23	Cave 2	½ sec.	PNN	0.30	2	501 p	.....	668 c	
M -137	Mummy Cave	v-cut	PNN	0.34	2	509 p	.....	656 c	
M -181	Del Muerto Cave 1	v-cut	PNN	0.44	2	626 p	.....	787+vv	
Comparative Specimens from Other Areas									
FR - 20	Allantown	ch. sq. cut	PNN	0.40	2	592 p	.....	756 vv	
CK -331	Chetro Ketl	¼ sec.	PP	0.97	½	643 p	.....	.....	

<sup>4</sup>Schulman, Tree-Ring Bulletin 12:18-24, 1946.

Table 1b. Dated Specimens from the Durango Area

Specimen No.	Site	Form <sup>1</sup>	Species <sup>2</sup>	Mean Ring-Width, mm. <sup>3</sup>	Plot Scale <sup>4</sup>	Inner Ring, A.D. <sup>5</sup>	Heart-wood Ends, A.D.	Outer Ring, A.D. <sup>6</sup>
ADE- 35	Falls Creek	ch. ¼ sec.	DF	0.67	1	126 p	.....	174 vv
AF - 2	Falls Creek	ch. fr.	DF	0.35	1	134	.....	206 vv
AH - 1	Falls Creek	ch. fr.	DF	0.42	1	141	.....	198 vv
2H - 30	Falls Creek	fr.	DF	0.43	1	146	.....	203 b
2H - 41	Falls Creek	sec.	DF	0.99	½	150 p	.....	194 v
AB - 1	Falls Creek	fr.	PP	1.02	.....	206	.....	260 vv
III - 4	IGN 7:101	ch. ½ sec.	DF	0.35	1	106	.....	188 c
II - 3	IGN 7:101	ch. ½ sec.	DF	1.24	½	138 p	.....	184 vv
II - 1	IGN 7:101	ch. ¼ sec.	DF	0.88	½	143	.....	200+b
III - 1	IGN 7:101	ch. fr.	DF	0.93	½	141 p	.....	214 vv
II - 2	IGN 7:101	ch. fr.	DF	0.35	2	151	.....	208 vv
I - 1A <sup>11</sup>	IGN 7:101	ch. sec.	DF	0.24	1	156 p	.....	197±
I - 1	IGN 7:101	ch. ¼ sec.	DF	0.76	½	177	.....	271 vv
I - 9	IGN 7:101	ch. ¼ sec.	DF	0.58	½	173 p	.....	308+b
I - 6	IGN 7:101	ch. ¼ sec.	DF	0.90	½	267 p	.....	314 vv
I - 12	IGN 7:101	ch. fr.	DF	0.92	½	292 <sup>12</sup>	.....	322 vv
DPL- 2	?	¼ sec.	PP	1.32	½	254	.....	349 vv
IF - 91	IGN 17A:6	fr.	PP	1.13	1	398	.....	494 vv
IF -106	?	ch. ½ sec.	PP	1.42	½	447 p	.....	502 vv
IF -160	?	¼ sec.	PP	0.57	1	474 p	.....	597 vv
IF -135	?	fr.	PP	1.55	½	471	.....	539 vv
IGN -7:2 <sup>12</sup>	Falls Creek	sec.	PP	0.99	½	530 p	.....	650 b
IF -124	?	fr.	PP	0.94	1	532	.....	583 vv
1	IGN 16A:1	fr.	PP	0.90	1	553	.....	636 vv
IF -104	?	¼ sec.	PP	0.87	1	521 p	.....	625 vv
IF - 92	?	¼ sec.	PP	0.78	1	582	.....	663 vv
IF -154	?	fr.	PP	0.71	1	610	.....	684 vv
IF -109	?	fr.	PNN	0.17	5	669	.....	.....

Table 2a. Tree-Ring Indices for Douglas Fir in Northeastern Arizona: Ring-Widths in Per Cent of the Growth Trend\*

A.D.	0	1	2	3	4	5	6	7	8	9
10	.....	111	102	86	97	63	104	138	94	109
20	88	122	182	112	93	88	74	105	106	64
30	156	85	80	106	74	67	67	54	66	53
40	55	44	47	51	63	80	91	87	104	76
50	82	69	69	47	77	83	68	61	62	53
60	69	97	102	138	171	131	180	79	89	100
70	81	67	86	80	81	73	140	132	114	156
80	114	94	120	112	116	73	59	100	88	95
90	118	109	128	143	92	100	123	170	110	175
100	89	75	71	88	97	125	118	106	112	54
110	133	108	116	116	120	109	98	92	106	122
120	109	97	108	81	120	88	88	75	84	94
130	137	55	110	76	73	73	90	62	94	71
140	92	87	114	87	98	71	113	73	93	91

<sup>1</sup>Wood unless otherwise noted. ch—charcoal; fr—fragment; sec—section; sq—square.

<sup>2</sup>DF—Douglas fir; PP—ponderosa pine; PNN—pinyon pine.

<sup>3</sup>Over measured interval plotted in the figure.

<sup>4</sup>1—standard vertical scale of 0.50 mm ring-width per scale division on margin of Figure 1; ½—1.00 mm per scale division; 2—0.25 mm; 5—0.10 mm.

<sup>5</sup>p—pith ring.

<sup>6</sup>b—bark present; c—outside ring constant along outer face of specimen, probably very few or no rings lost; vv—outside date very variable, probably many rings lost; v—outside date variable, probably several rings lost.

+—outer rings very crowded, probably some absent in series.

<sup>7</sup>Plotted over interval 11-305 only; outer rings complacent and variable.

<sup>8</sup>Mummy Cave on microfilm, text reference 1, 1939.

<sup>9</sup>Broken Flute Cave on microfilm, text reference 1, 1939.

<sup>10</sup>507 in text reference 1, 1936.

<sup>11</sup>Branch buried in stem section I-1.

<sup>12</sup>Other fragments not measured extend the sequence back some years.

<sup>13</sup>A v-cut numbered 2H-60 in the Falls Creek collection received in 1948 was identified as from the same tree as this section received in 1939.

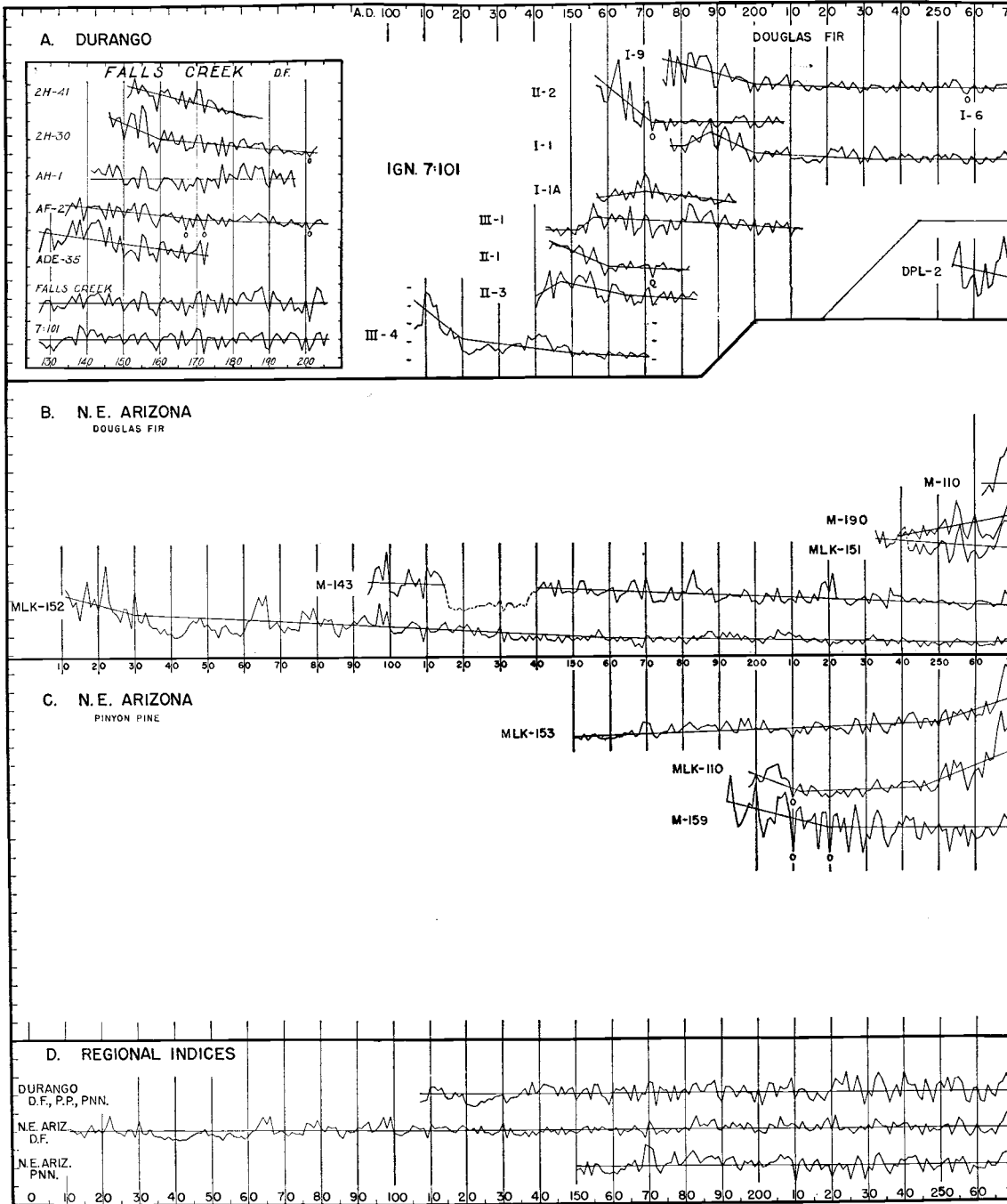
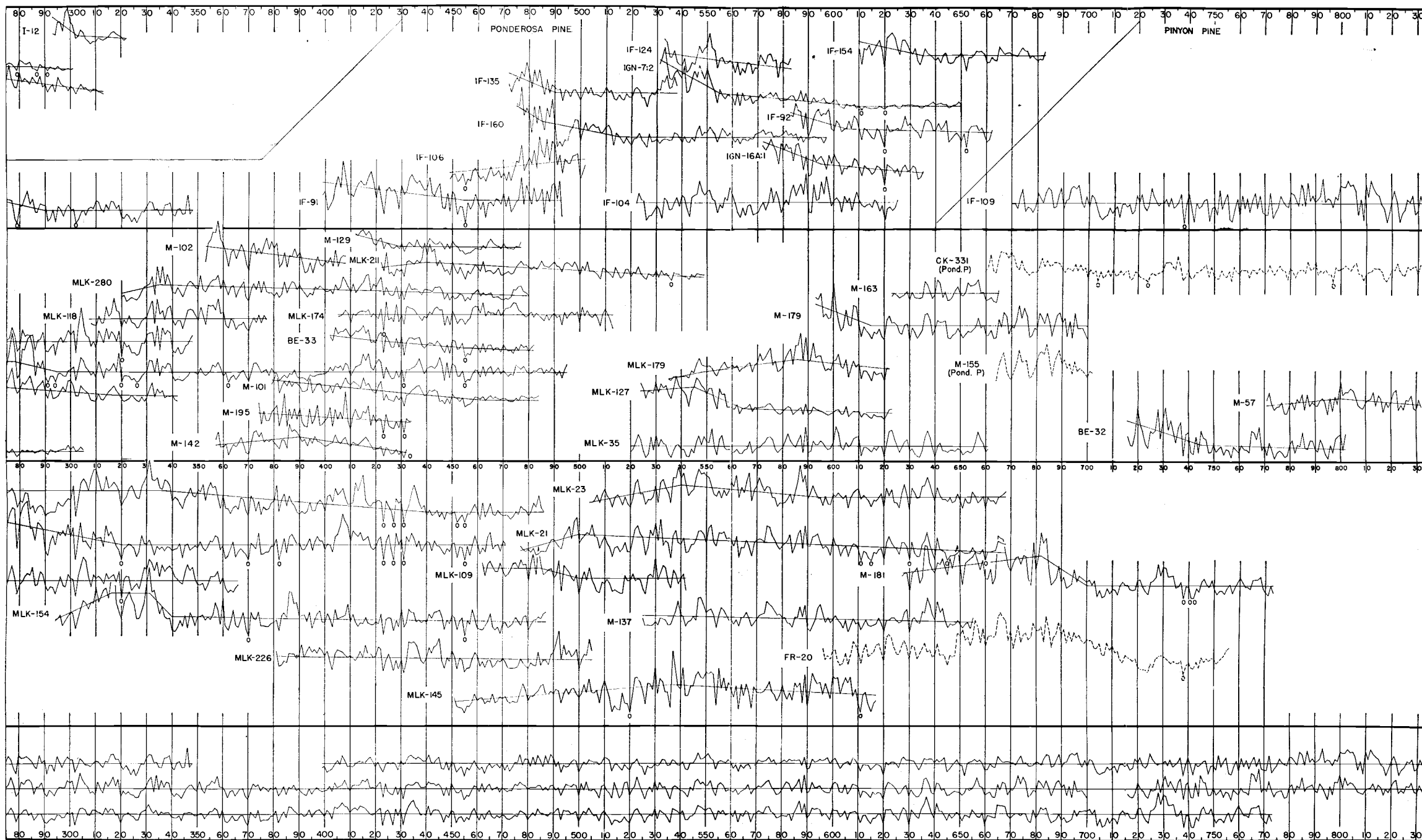


Fig. 1. Growth records in early ruins of the San Juan basin. Ring-width measurements of dated beams are plotted in panels A, B, and C; trend (or standardizing) lines are superposed. Zeros below the curves indicate locally-absent rings. To avoid overcrowding, the vertical scale of the growth curve plotted in panels A to C is omitted, but may be found in all cases by reference to Table 1, sixth column, the absolute



minimum of each curve being at or near 0.0 mm. Broken-line curves in panels B and C represent specimens from other areas or of different species which are plotted here as comparison records during the poorly represented 700's and late 600's.

In panel D are plotted standardized mean growth indices: separately for Douglas fir and pinyon pine in northeastern Arizona; a combined index for Durango.



Table 2b. Tree-Ring Indices for Pinyon Pine in Northeastern Arizona:  
Ring-Widths in Per Cent of the Growth Trend\*

A.D.	0	1	2	3	4	5	6	7	8	9
150	80	88	58	122	46	109	107	70	60	58
160	66	57	81	79	109	100	128	67	96	210
170	200	190	84	56	96	108	113	83	162	103
180	133	156	179	146	108	131	141	145	132	142
190	90	122	133	141	89	67	118	104	120	83
200	120	82	92	110	112	125	153	130	142	122
210	09	109	132	81	61	116	129	68	90	90
220	32	86	104	71	99	19	89	144	111	19
230	84	64	141	160	109	63	43	98	88	124
240	118	137	135	144	99	55	123	94	62	81
250	87	112	128	48	120	105	136	93	38	85
260	71	73	66	111	85	85	114	153	161	151
270	93	146	157	157	101	88	116	144	116	35
280	90	101	127	134	88	107	52	80	104	94
290	39	28	51	62	50	86	93	71	76	111
300	92	111	14	85	141	143	132	93	90	133
310	131	115	108	93	148	110	139	138	92	95
320	23	85	96	110	87	80	56	56	112	124
330	136	178	134	108	133	92	120	105	116	116
340	81	74	75	88	49	108	110	117	113	89
350	94	103	105	66	97	123	122	152	137	72
360	132	45	38	60	90	52	57	91	93	44
370	08	119	95	74	134	44	57	56	58	84
380	88	129	31	84	121	75	160	156	129	111
390	94	103	84	93	134	74	106	126	136	110
400	82	128	108	62	154	143	161	186	158	155
410	109	138	147	129	162	153	143	118	98	94
420	105	132	145	08	117	131	87	14	137	87
430	141	16	101	158	192	205	154	137	87	103
440	94	160	93	131	135	130	93	37	95	74
450	125	116	30	74	80	38	76	57	117	146
460	97	54	104	60	108	134	84	71	90	78
470	95	90	66	61	76	94	83	129	120	106
480	62	89	114	90	146	110	107	100	88	114
490	109	126	151	58	134	125	126	103	110	123
500	49	92	124	106	153	115	93	98	48	105
510	129	97	71	19	55	55	39	48	80	50
520	36	87	132	144	105	83	31	78	94	85
530	143	68	131	115	100	74	34	142	135	121
540	100	127	58	58	81	90	114	167	158	147
550	126	147	146	104	52	126	107	128	93	103
560	106	79	125	35	99	82	126	114	36	97
570	106	124	115	110	159	160	119	104	70	77
580	89	84	82	106	45	113	148	204	108	182
590	65	93	148	138	143	138	85	108	88	57
600	141	127	128	78	89	123	56	109	114	119
610	98	31	88	91	50	25	66	68	98	102
620	22	136	133	139	94	82	49	112	150	125
630	15	132	105	82	67	140	176	236	170	111
640	68	186	123	123	92	49	98	68	86	116
650	93	49	90	84	75	134	111	81	77	113
660	23	85	82	75	72	170	165	166	160	85
670	68	89	103	104	85	105	102	48	32	133
680	70	103	154	137	154	80	37	47	62	103
690	55	76	39	48	62	133	84	126	125	132
700	128	144	104	140	12	64	04	16	76	36
710	72	64	28	104	132	104	108	72	68	72
720	144	152	92	56	32	132	140	168	272	180
730	248	244	172	176	180	88	96	132	00	96
740	92	00	00	80	48	132	156	108	102	144
750	72	32	60	60	36	84	112	40	88	128
760	164	128	92	92	76	144	148	152	172	76
770	48	24	100	44	.....	.....	.....	.....	.....	.....

\*The number of trees on which these indices are based may be obtained, for any date, by inspection of the figure.