

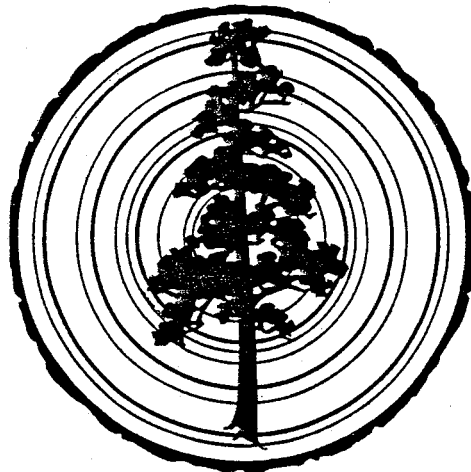
# TREE-RING BULLETIN

VOL. 6

JULY, 1939

No. 1

A Quarterly



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Edmund Schulman, Managing Editor  
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Tucson, Arizona

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## THE TREE-RING BULLETIN

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## AUTHORS

The Tree-Ring Bulletin will publish papers resulting from original research in tree-rings in relation to climatology, archaeology, and other fields. For reports of projects in tree-ring dating, a tabular form as in Vol. 1, No. 1 is suggested. Until funds are available authors will be requested to pay the cost of illustrations. Each contributor will be given twenty-five copies of the Bulletin in which his article appears.

## SUBSCRIBERS

All correspondence regarding subscriptions should be addressed to Mr. Edmund Schulman, Tree-Ring Laboratory, University of Arizona, Tucson, Arizona.

## EDITORIAL

For the present year it is planned to devote each issue of the Bulletin mainly to one general subject. Thus, the first number is largely along archaeological lines, the second will contain material relating to the climatic phase of tree-ring analysis, and another will contain a bibliography. It is hoped that this arrangement will make for greater ease of reference.

## FIFTH ANNUAL TREE-RING CONFERENCE

ROY LASSETTER

The Fifth Annual Tree-Ring Conference met at the summer field camp of the Arizona State Museum at Forestdale, Arizona, near Showlow, on July 22nd and 23rd, 1939. Dr. A. E. Douglass presided at the meetings.

Those attending the conference were: Mr. Gordon C. Baldwin, Dr. A. E. Douglass, Mr. Paul Ezell, Mr. I. F. Flora, Mr. H. T. Getty, Mr. Thomas Hale, Mr. Edward T. Hall, Mr. Lyndon L. Hargrave, Dr. Emil W. Haury, Mr. Roy Lassetter, Mr. Albert Schroeder, Mr. Edmund Schulman, Mr. Donovan Senter, Dr. Florence Hawley Senter, Mr. W. S. Stallings, Jr., and the students of the field camp. It was learned with regret that both Dr. H. S. Colton and Mr. John C. McGregor were unable to attend because of illness.

The qualifications for election to Fellow were changed to read: investigators who have contributed outstanding work in dendrochronology and have been approved by the Fellows of the Society.

Some topics reported on and discussed: Dr. A. E. Douglass, exact method of identifying Douglas fir, by the spiral thickening of the cell walls seen under a power of 60X or more; I. F. Flora, compression wood and its possible dependence on reduction of pressure under the bark, on the under side of a bent trunk; Edward T. Hall, handling of charcoal in the field recommending reduction in the use of paraffine or even its elimination because it clouds the charcoal surface under preparation for microscope or photograph (a saturated solution of paraffine in gasoline is usually too strong—A.E.D.); Dr. Florence Hawley Senter, treatment of rotten wood and wet charcoal with a solution of acetone and bakelite; Mr. W. S. Stallings, Jr., publication of tree-ring work; Dr. Emil W. Haury, professional work on tree-ring material.

A resolution was adopted to the effect that it was the sense of the conference that a published technical report of the tree-ring material include descriptions, photographic if possible, of the ring sequences and the basic

evidence underlying the dating. These should accompany the final report of the associated archaeological work as an appendix or appear in other recognized channels of publication. In contracts or agreements for the study and dating of such material it should be stipulated that the agent contracting for such study assume responsibility for this needed publication unless the same can be done by the dendrochronologist.

## ELECTIONS

|                     |                         |                          |
|---------------------|-------------------------|--------------------------|
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|                     | Botany                  | Dr. Charles J. Lyon      |
| Fellows:            | Mr. I. F. Flora         | Mr. Edward T. Hall       |
|                     | Mr. J. L. Giddings, Jr. | Dr. Charles J. Lyon      |

A vote of thanks to the hosts, Dr. E. W. Haury and the Field Camp, ended the business sessions. The society was fortunate in being able to hold the conference near Showlow, where ten years ago the famed "gap" was closed.

## NOTES ON BEAM DATING BY SAP-HEART CONTACT

A. E. DOUGLASS

A large proportion of the specimens collected by the National Geographic Society Beam Expeditions in the Hopi villages came from logs that had been in use for hundreds of years and were badly worn in the outer rings. In many cases the entire sapwood was gone. The main purpose of this paper is to call attention to the estimated losses of important rings on the outside of specimens whose remaining rings are perfectly dated and to lay a foundation for more accurate estimates in the future. These specimens were collected by Mr. Lyndon L. Hargrave, then connected with the Museum of Northern Arizona. He made very full notes of the locations of these beams and together he and I made memoranda of the buildings then standing in Old Oraibi on the mesa top and at other villages.\*

A publication of resulting dates was made in "Dating Pueblo Bonito and Other Ruins of the Southwest", National Geographic Society Contributed Technical Papers, No. 1 in the Pueblo Bonito Series, 1935. These dates were given in considerable numbers without stating the specimen identity, an omission which the current and two previous lists by Mr. Peterson are intended to supply.

The Hopi ring chronology was solved in April, 1928. In August of that year specimens were found giving actual dates of some of the Jeddito prehistoric ruins. Therefore tables were made of the outer dated rings and it was at once evident that there were heavy losses of outside rings. Then "sap-heart" dating was introduced to get nearer the actual cutting date. At that time the "Gap" in the late 1200's had not been closed and for the first approximation of cutting dates a rough average of sapwood duration was taken as about 50 years. This was added to the date of sap-heart contact and gave the first estimates that were published as above stated.

\*These records are in our files.

On recent review of this problem of sap-heart dating of beams, the first improvement is the distinction between pine and Douglas fir (often called spruce) in which the pine sapwood often contains 60 to 75 rings and the fir 30 to 35. It is recognized that this again is not the final solution but a satisfactory solution will require the examination and measurement of great numbers of specimens which cannot be completed without long delay.

With this difference in the duration of sapwood in pine and fir, it becomes important to be sure of the species, and because it is not always easy to distinguish the species of wood or charcoal the dated specimens in the accompanying lists have all been checked by microscopic tests. This is not difficult since it is only necessary to obtain some minute radial slices parallel to the grain (tangential slices are a little less certain to give results) by shaving the specimen with a sharp razor; the shavings are caught on a piece of glass and surveyed with a power of X90 or so, using transmitted light or sometimes even reflected light. It can often be done with X60. What we call "fur", the spiral thickening of the cell walls, can easily be seen in the Douglas firs but is absent in the pines. This test can be used on charcoal as on wood and the entire process usually takes only two or three minutes.

There are two species of pines in the area used in our studies, the ponderosa or western yellow pine and the *edulis* or pinyon. These are readily distinguished by odor, the latter having a very strong pitchy smell. Resin ducts offer another method of identification. They may be seen with a small glass on a radial surface cut forty-five degrees to the grain and illuminated so as to cause reflection on the cell walls. Pinyon has many ducts and very thin latewood in nearly all but the first thirty rings; pine has a few irregularly distributed ducts with much wider latewood in normal years; Douglas fir usually has no ducts or may have a very few often stringing along the circuit of the tree parallel to the red latewood. Douglas fir rings under strong compression as on steep hillsides have been found to be immensely dense and heavy in favorable years.

The outline of the heartwood is usually a little irregular, reaching out sometimes through many rings in some limited direction. At one point in OL-12, a pine\* in the Flagstaff Cinder area, a band of heartwood extends out into the sapwood two inches, covering rings 1829-1902 to a pocket of resin which may be a lightning scar. The heartwood also has certain irregularities in connection with large living branches.

In the giant sequoias lightning scars and burnt areas that injure the cambium present "shadows" composed of sapwood on the inner side of the injury, all surrounded by heartwood.

In spite of these occasional lapses, there is a traceable outline of the heartwood around the circuit so that in most cases its date has a real relation to the outside of the sapwood which is the bark date.

The sapwood is narrow in the Douglas fir (spruce) being usually about one inch thick. In the pine it is often three inches thick but may be as little as one inch in rare cases.

In the tables of this issue the species has been checked microscopically by Mr. Edmund Schulman or the writer. For these lists the average sapwood duration in years has been taken as about 30 or 35 years in the Douglas fir and 60 to 75 in the pine, as above noted. These values are provisional and will sometime be discussed again. Absence of sap-heart contact occurs in almost half of the specimens in this list. This may be caused by special growing conditions without loss of the outside rings (which is probably rare) or by actual loss at the outside. Some reference as to which of these alternatives occurred may be obtained in many cases by the color of the

\*Discussed in W. S. Glock, *Principles and Methods of Tree-Ring Analysis*, Carnegie Inst. Wash. Pub. 486, 31-62, 1937.

remaining wood and occasionally by the changing size of the outer rings and more often by the continuity of rings around the outside.

The assignment of ring types in table 1 was made by the writer. In the ring types, A stands for very high crossdating quality while D indicates that the ring series is too complacent to date. Microscopic examination has shown that in some cases earlier identification of species for some BE's was incorrect; the revised list is published herewith in table 1a. The photo reproductions noted in table 1 refer to Series A of the micro-film copies of some 800 photographs of ring series. These form a small part of those used in producing the southwestern ring chronology. Copies of this film may be obtained through the Bibliofilm Service, Department of Agriculture, Washington, D. C.

It may be very difficult to duplicate these Hopi collections and so a real value is thought to reside in this more detailed description. Estimated outside dates, which we call "bark dates", as given in Mr. Peterson's list are necessarily provisional and subject to further revision when the correction described above is better known.

TABLE 1a. RING TYPE AND SPECIES OF DATED SPECIMENS NUMBERED BE 1 TO 168.

| BE Number | Species | Quality | MFA <sup>1</sup> | BE Number | Species | Quality | MFA <sup>1</sup> |
|-----------|---------|---------|------------------|-----------|---------|---------|------------------|
| 4         | DF      | BC      | *                | 104       | DF      | B       |                  |
| 5         | P       | BC      |                  | 106       | DF      | BC      |                  |
| 7         | P       | A       |                  | 107       | P       | BC      |                  |
| 8         | DF      | B       |                  | 108       | DF      | B       |                  |
| 9         | DF      | B       |                  | 109       | DF      | AB      | *                |
| 10        | P       | AB      | *                | 112       | DF      | AB      | *                |
| 11        | DF      | AB      | *                | 113       | DF      | B       |                  |
| 14        | P       | BC      |                  | 114       | DF      | BC      |                  |
| 15        | DF      | AB      | *                | 115       | DF      | AB      |                  |
| 17        | P       | BC      |                  | 118       | DF      | B       |                  |
| 18        | P       | BC      |                  | 119       | DF      | B       |                  |
| 19        | DF      | B       |                  | 120       | DF      | AB      |                  |
| 21        | P       | B       | *                | 121       | DF      | B       |                  |
| 22        | P       | B       |                  | 122       | DF      | B       | *                |
| 32        | DF      | A       | *                | 125       | DF      | AB      | *                |
| 33        | DF      | AB      |                  | 126       | DF      | B       |                  |
| 34        | DF      | A       | *                | 127       | DF      | B       |                  |
| 35        | DF      | AB      | *                | 128       | DF      | AB      | *                |
| 36        | DF      | AB      | *                | 129       | DF      | B       |                  |
| 37        | P       | BC      |                  | 133       | DF      | D       |                  |
| 38        | P       | B       | *                | 134       | DF      | AB      | *                |
| 39        | DF      | B       | *                | 135       | DF      | A       | *                |
| 43        | P       | B       | *                | 136       | DF      | BC      | *                |
| 49        | DF      | B       |                  | 138       | DF      | B       | *                |
| 50        | DF      | A       | *                | 139       | DF      | B       |                  |
| 63        | DF      | AB      |                  | 146       | DF      | BC      |                  |
| 65        | DF      | BC      |                  | 147       | DF      | A       |                  |
| 66        | DF      | C       |                  | 148       | DF      | AB      |                  |
| 67        | DF      | A       | *                | 151       | DF      | B       |                  |
| 73        | JUN     | AB      | *                | 159       | DF      | A       |                  |
| 74        | P       | B       |                  | 160       | DF      | B       |                  |
| 90        | P       | BC      |                  | 161       | DF      | AB      |                  |
| 94        | P       | C       |                  | 162       | DF      | B       |                  |
| 96        | P       | BC      |                  | 163       | DF      | AB      |                  |
| 98        | P       | B       |                  |           |         |         |                  |

<sup>1</sup>Micro-film, Series A, 1939; starred numbers indicate that the ring series has been photographed and included in the micro-film.

TABLE 1b. RING TYPE OF DATED SPECIMENS NUMBERED BE 169 TO 309.

| BE Number | Quality | MFA | BE Number | Quality | MFA | BE Number | Quality | MFA |
|-----------|---------|-----|-----------|---------|-----|-----------|---------|-----|
| 169       | A       |     | 220       | AA      |     | 268       | B       |     |
| 170       | A       |     | 220x      | A       |     | 269       | A       | *   |
| 171       | A       |     | 221       | BC      |     | 271       | A       |     |
| 171A      | A       |     | 222       | BC      |     | 272       | A       |     |
| 174       | AB      |     | 223       | A       | *   | 273       | A       | *   |
| 177       | A       | *   | 224       | AB      |     | 274       | A       | *   |
| 178       | A       |     | 226       | A?      |     | 275       | A       |     |
| 180       | A       |     | 228       | A       |     | 276       | A       | *   |
| 183       | A       | *   | 231       | A       |     | 277       | A       |     |
| 184       | A       |     | 232       | AB      |     | 278       | AB      |     |
| 185       | A       |     | 233       | A       |     | 279       | AB      | *   |
| 187       | A       |     | 234       | A       | *   | 280       | AA      | *   |
| 189       | AB      |     | 236       | B       |     | 281       | BC      |     |
| 190       | A       |     | 238       | A       | *   | 284       | AB      |     |
| 192       | A       | *   | 239       | A       |     | 285       | AB      |     |
| 194       | B       |     | 240       | A       |     | 286       | B       |     |
| 200       | A       |     | 241       | A       |     | 287       | A       | *   |
| 201       | A       |     | 242       | AB      |     | 288       | A       |     |
| 202       | A       |     | 244       | A       |     | 289       | A       |     |
| 203       | B       |     | 245       | AB      |     | 290       | A       |     |
| 204       | A       |     | 249       | A       |     | 291       | A       |     |
| 205       | AB      |     | 250       | A       | *   | 293       | B       |     |
| 206       | B       |     | 251       | AA      | *   | 294       | A       | *   |
| 207       | B       |     | 252       | A       |     | 295       | A       | *   |
| 208       | AB      |     | 253       | A       | *   | 296       | BC      | *   |
| 210       | AB      |     | 254       | BC      |     | 297       | A       |     |
| 211       | AB      |     | 255       | B       |     | 298       | A       |     |
| 213       | AB      |     | 256       | AB      |     | 299       | A       | *   |
| 214       | AB      |     | 257       | A       |     | 300       | AB      |     |
| 215       | A       | *   | 261       | A       |     | 301       | A       | *   |
| 216       | AA      |     | 262       | A       | *   | 304       | A       | *   |
| 217       | B       |     | 264       | A       | *   | 307       | B       |     |
| 218       | AA      |     | 265       | A       | *   | 308       | AB      |     |
| 219       | A       |     | 267       | A       |     | 309       | A       |     |

THIRD REPORT' ON HOPI SPECIMENS:  
COLLECTIONS OF SECOND BEAM EXPEDITION, 1928.

ALFRED PETERSON

Site: All from Oraibi.

| BE Spec. Number | Outside Dated Ring | Inside Dated Ring | Radius, mm. | Species by Microsc. Test | Form of Specimen | Date of Sap-Heart Contact | Estimated Rings Lost at Outside | Number Absent in Series | Estimated Bark Date <sup>2</sup> |
|-----------------|--------------------|-------------------|-------------|--------------------------|------------------|---------------------------|---------------------------------|-------------------------|----------------------------------|
| 169             | 1572               | 1536              | 34          | DF                       | ½ Sec.           | 1551                      | 10 ± 5                          | 0                       | 1582 ± 5                         |
| 170             | 1754               | 1649              | 56          | DF                       | Sq. Cut          | 1718                      | 0                               | 0                       | 1754                             |
| 171             | 1464               | 1337              | 66          | DF                       | Core             | 1420                      | 0                               | 3-4                     | 1464 ± 2                         |
| 171A            | 1515               | 1466              | 33          | DF                       | Core             | 1513                      | 30 ± 10                         | 1                       | 1545 ± 10                        |
| 174             | 1712               | 1651              | 48          | DF                       | Core             | 1681                      | 3 ± 2                           | 0                       | 1715 ± 2                         |
| 177             | 1635               | 1537              | 63          | DF                       | ¼ Sec.           | 1592                      | 2 ± 2                           | 0                       | 1637 ± 2                         |
|                 |                    |                   |             |                          |                  | All                       |                                 |                         |                                  |
| 178             | 1380               | 1320              | 89          | DF                       | V-Cut            | Heart                     | 30 ± 10                         | 0                       | 1410 ± 10                        |
| 180             | 1691               | 1648              | 30          | DF                       | ⅓ Sec.           | 1667                      | 1 ± 1                           | 0                       | 1692 ± 1                         |
| 183             | 1564               | 1324              | 177         | DF                       | Core             | No <sup>2</sup>           | 15 ± 15                         | 7                       | 1579 ± 15                        |
| 184             | 1621               | 1419              | 153         | Pine                     | Core             | No ?                      | 30 ± 30                         | 5                       | 1651 ± 30                        |
| 185             | 1730               | 1621              | 99          | DF                       | Core             | 1682                      | 0                               | 0                       | 1730                             |
| 187             | 1723               | 1609              | 94          | DF                       | Core             | No ?                      | 15 ± 15                         | 0                       | 1738 ± 15                        |
| 189             | 1630               | 1479              | 140         | Pine                     | Core             | No ?                      | 30 ± 30                         | 15 <sup>2</sup>         | 1660 ± 30                        |

| BE Spec. Number | Outside Dated Ring | Inside Dated Ring | Radius, mm. | Species by Microsc. Test | Form of Specimen | Date of Sap-Heart Contact | Estimated Rings Lost at Outside | Number Absent in Series | Estimated Bark Date <sup>2</sup> |
|-----------------|--------------------|-------------------|-------------|--------------------------|------------------|---------------------------|---------------------------------|-------------------------|----------------------------------|
| 190             | 1378               | 1285              | 105         | DF                       | Core             | All Heart                 | 30±5                            | 1                       | 1408±5                           |
| 192             | 1610±5             | 1418              | 64          | DF                       | Core             | 1555                      | 10±10                           | 10±                     | 1620±15                          |
| 194             | 1689               | 1645              | 84          | DF                       | Core             | 1681                      | 25±5                            | 0                       | 1714±5                           |
| 200             | 1475               | 1344              | 67          | DF                       | ¼ Sec.           | All Heart                 | 30±20                           | 4                       | 1505±20                          |
| 201             | 1710               | 1578              | 122         | DF                       | Core             | 1692                      | 15±5                            | 4                       | 1725±5                           |
| 202             | 1566               | 1465              | 85          | DF                       | Core             | All Heart                 | 30±5                            | 0 or 1                  | 1596±5                           |
| 203             | 1520               | 1405              | 105         | Pine                     | Core             | No                        | 30±30                           | 2                       | 1550±30                          |
| 204             | 1547               | 1312              | 145         | Pine                     | Core             | No                        | 30±30                           | 4                       | 1577±30                          |
| 205             | 1619               | 1462              | 143         | Pine                     | Core             | No                        | 30±30                           | 3                       | 1649±30                          |
| 206             | 1601-2             | 1462              | 145         | Pine                     | Core             | 1535?                     | 30±30                           | 3                       | 1631±30                          |
| 207             | 1556               | 1479              | 117         | Pine                     | Core             | 1507                      | 15±15                           | 4                       | 1571±15                          |
| 208             | 1562               | 1499              | 112         | Pine                     | Core             | No                        | 30±30                           | 0                       | 1592±30                          |
| 210             | 1621               | 1505              | 70          | Pine                     | 1/5 Sec.         | All Heart                 | 60±20                           | 2                       | 1681±20                          |
| 211             | 1702               | 1648              | 39          | DF                       | ¼ Sec.           | No                        | 3±3                             | 0                       | 1705±3                           |
| 213             | 1532               | 1469              | 98          | Pine                     | Core             | All Heart                 | 60±10                           | 1                       | 1592±10                          |
| 214             | 1550               | 1488              | 113         | Pine                     | Core             | 1534?                     | 44±20                           | 0                       | 1594±20                          |
| 215             | 1629               | 1485              | 155         | DF                       | Core             | 1577                      | 0                               | 0                       | 1629                             |
| 216             | 1619               | 1495              | 99          | DF                       | Sec.             | 1581                      | 8±8                             | 6                       | 1627±8                           |
| 217             | 1424               | 1358              | 67          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1454±10                          |
| 218             | 1543               | 1511              | 48          | DF                       | ½ Sec.           | 1527                      | 14±5                            | 0                       | 1557±5                           |
| 219             | 1710               | 1660              | 85          | DF                       | Core             | 1684                      | 5                               | 0                       | 1715±5                           |
| 220             | 1562               | 1517              | 41          | DF                       | V-Cut            | 1538                      | 4±4                             | 0                       | 1566±4                           |
| 220A            | 1633               | 1543              | 68          | DF                       | Core             | 1595                      | 0?                              | 2                       | 1633                             |
| 221             | 1491               | 1298              | 85          | DF                       | Sec.             | 1476?                     | 15±15                           | 3                       | 1506±15                          |
| 222             | 1682               | 1641              | 80          | DF                       | Core             | 1660                      | 10±5                            | 0                       | 1692±5                           |
| 223             | 1675               | 1618              | 85          | DF                       | Core             | 1656±2                    | 10±5                            | 0                       | 1685±5                           |
| 224             | 1491               | 1320              | 116         | DF                       | V-Cut            | All Heart                 | 30±20                           | 3                       | 1521±20                          |
| 226             | 1562               | 1516              |             | DF?                      | Sec.             | 1542                      | 20±20                           |                         | 1582±20                          |
| 228             | 1539               | 1513              | 34          | DF                       | Sec.             | 1531                      | 22±5                            | 0                       | 1561±5                           |
| 231             | 1528               | 1462              | 85          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1558±10                          |
| 232             | 1678               | 1618              | 99          | DF                       | Core             | 1664                      | 16±10                           | 0                       | 1694±10                          |
| 233             | 1678±2             | 1604              | 32          | DF                       | Sec.             | 1653                      | 10±10                           | 0?                      | 1688±10                          |
| 234             | 1621               | 1524              | 84          | DF                       | V-Cut            | 1583                      | 10±10                           | 1                       | 1631±10                          |
| 236+            | 1323               | 1300              | 66          | DF                       | Core             | All Heart                 | 35±10                           | 0                       | 1358±10                          |
| 238             | 1424               | 1363              | 52          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1454±10                          |
| 239             | 1628               | 1479              | 75          | DF                       | Core             | 1580                      | 0?                              | 2                       | 1628                             |
| 240             | 1455               | 1363              | 50          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1485±10                          |
| 241             | 1563               | 1530              | 44          | DF                       | Sec.             | 1552                      | 20±10                           | 0                       | 1583±10                          |
| 242             | 1634               | 1547              | 64          | DF                       | Core             | 1598                      | 5±5                             | 2                       | 1639±5                           |
| 244             | 1468               | 1393              | 111         | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1498±10                          |
| 245             | 1724               | 1689              | 40          | DF                       | ½ Sec.           | 1704                      | 2±2                             | 0                       | 1726±2                           |
| 246             | 1619               | 1580              | 37          | DF                       | V-Cut            | 1597                      | 5±5                             | 0                       | 1624±5                           |
| 249             | 1730               | 1689              | 44          | DF                       | Sec.             | 1705                      | 5±5                             | 0                       | 1735±5                           |
| 250             | 1482               | 1392              | 75          | DF                       | Core             | All Heart                 | 30±10                           | 3                       | 1512±10                          |
| 251             | 1531               | 1485              | 41          | DF                       | V-Cut            | 1528                      | 27±10                           | 0                       | 1558±10                          |
| 252             | 1598               | 1574              | 67          | DF                       | Core             | All Heart                 | 30±10                           | 1                       | 1628±10                          |
| 253             | 1461               | 1400              | 73          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1491±10                          |
| 254             | 1631               | 1527              | 93          | Pine                     | Core             | 1546                      | 0                               | 0                       | 1631                             |
| 255             | 1712               | 1651              | 74          | DF                       | Sec.             | 1678                      | 2±2                             | 0                       | 1714±2                           |

| BE Spec. Number | Outside Dated Ring | Inside Dated Ring | Radius, mm. | Species by Microsc. Test | Form of Specimen | Date of Sap-Heart Contact | Estimated Rings Lost at Outside | Number Absent in Series | Estimated Bark Date <sup>2</sup> |
|-----------------|--------------------|-------------------|-------------|--------------------------|------------------|---------------------------|---------------------------------|-------------------------|----------------------------------|
| 256             | 1429               | 1344              | 65          | DF                       | Core             | 1425                      | 25±5                            | 0                       | 1454±5                           |
| 257             | 1490               | 1439              | 76          | DF                       | 1/8 Sec.         | All Heart                 | 30±5                            | 0                       | 1520±5                           |
| 261             | 1548               | 1463              | 135         | DF                       | V-Cut            | 1532                      | 14±5                            | 0                       | 1562±5                           |
| 262             | 1550               | 1508              | 60          | DF                       | 1/4 Sec.         | All Heart                 | 35±10                           | 0                       | 1585±10                          |
| 264             | 1633               | 1556              | 75          | DF                       | Core             | 1597                      | 5±5                             | 0                       | 1638±5                           |
| 265             | 1552               | 1486              | 38          | DF                       | Sec.             | 1534                      | 12±5                            | 0                       | 1564±5                           |
| 267             | 1513               | 1419              | 94          | DF                       | Core             | No                        | 15±15                           | 2                       | 1528±15                          |
| 268             | 1365               | 1320              | 65          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1395±10                          |
| 269             | 1345               | 1260              | 89          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1375±10                          |
| 271             | 1494               | 1430              | 63          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1524±10                          |
| 272             | 1488               | 1322              | 85          | DF                       | Sq. Cut          | 1478                      | 20±10                           | 4                       | 1508±10                          |
| 273             | 1490               | 1424              | 56          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1520±10                          |
| 274             | 1467               | 1322              | 85          | DF                       | 1/8 Sec.         | All Heart                 | 30±10                           | 3                       | 1497±10                          |
| 275             | 1579               | 1535              | 45          | DF                       | V-Cut            | 1578                      | 30±10                           | 0                       | 1609±10                          |
| 276             | 1756               | 1614              | 79          | DF                       | Sec.             | 1690                      | 5±5                             | 3                       | 1761±5                           |
| 277             | 1546               | 1414              | 78          | DF                       | Sec.             | 1530                      | 18±10                           | 5                       | 1564±10                          |
| 278             | 1749               | 1614              | 51          | DF                       | Core             | 1700                      | 2±2                             | 0                       | 1751±2                           |
| 279             | 1749               | 1719              | 39          | DF                       | Core             | 1742                      | 25±5                            | 0                       | 1774±5                           |
| 280             | 1552               | 1515              | 31          | DF                       | 1/4 Sec.         | 1542                      | 20±5                            | 0                       | 1572±5                           |
| 281             | 1518               | 1363              | 92          | Pine                     | Core             | 1431                      | 1±1                             | 4                       | 1519±1                           |
| 284             | 1366               | 1309              | 76          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1396±10                          |
| 285             | 1557               | 1494              | 83          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1587±10                          |
| 286             | 1464               | 1375              | 57          | DF                       | Core             | All Heart                 | 15±15                           | 0                       | 1479±15                          |
| 287             | 1686               | 1612              | 50          | DF                       | V-Cut            | 1675                      | 20±10                           | 0                       | 1706±10                          |
| 288             | 1706               | 1665              | 45          | DF                       | V-Cut            | 1678                      | 3±3                             | 0                       | 1709±3                           |
| 289             | 1368               | 1325              | 72          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1398±10                          |
| 290             | 1564               | 1525              | 35          | DF                       | V-Cut            | 1556                      | 20±10                           | 0                       | 1584±10                          |
| 291             | 1575               | 1526              | 66          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1605±10                          |
| 293             | 1392               | 1330              | 75          | DF                       | Core             | 1390                      | 30±10                           | 0                       | 1422±10                          |
| 294             | 1674               | 1603              | 77          | DF                       | Core             | 1666                      | 26±10                           | 0                       | 1700±10                          |
| 295             | 1690               | 1620              | 62          | DF                       | Core             | 1671                      | 15±10                           | 0                       | 1705±10                          |
| 296             | 1625               | 1416              | 109         | DF                       | Core             | 1556                      | 3±3                             | 2                       | 1628±3                           |
| 297             | 1428               | 1321              | 87          | DF                       | Core             | All Heart                 | 35±10                           | 0                       | 1463±10                          |
| 298             | 1559               | 1468              | 85          | DF                       | Core             | All Heart                 | 30±10                           | 2                       | 1589±10                          |
| 299             | 1759               | 1651              | 49          | DF                       | V-Cut            | 1725                      | 1±1                             | 0                       | 1760±1                           |
| 300             | 1430               | 1358              | 77          | DF                       | Sq. Cut          | 1420                      | 25±10                           | 0                       | 1455±10                          |
| 301             | 1400               | 1305              | 90          | DF                       | Core             | All Heart                 | 30±10                           | 0                       | 1430±10                          |
| 304             | 1707               | 1615              | 90          | DF                       | V-Cut            | 1694                      | 20±5                            | 0                       | 1727±5                           |
| 307             | 1527               | 1491              | 64          | DF                       | Core             | 1516                      | 20±10                           | 0                       | 1547±10                          |
| 308             | 1711               | 1589              | 132         | Pine                     | Core             | 1624                      | 2±2                             | 0                       | 1713±2                           |
| 309             | 1708               | 1596              | 110         | DF                       | Core             | 1663                      | 12?                             | 0                       | 1720                             |

<sup>1</sup>Previous reports in vol. 1, 23-24, Jan. 1935, and vol. 3, 23-24, Jan. 1937. Oraibi specimens include nos. BE 1 to 10, and BE 101 to 310.

<sup>2</sup>For discussion of Bark Date see separate paper in this issue.

<sup>3</sup>BE 189 has a break in the middle of the core with about 15 rings lost. This does not affect the dating of the two parts of the core.

<sup>4</sup>BE 236 is the earliest dated beam in Oraibi.

<sup>5</sup>Sap-heart contact indeterminate and probably absent.

Note: The designations "P" and "Pine" for species refer to *P. ponderosa*.