[] Dendrochronology Program Library Run VMCSM Program COF 14:22 Tue 17 Jan 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 29969

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: VMC1235\_ACSA\_Corr6-50

File of DATED series: VMC1235\_ACSA\_Corr6\_Final

CONTENTS:

Part 1: Title page, options selected, summary, absent rings by series

Part 2: Histogram of time spans

Part 3: Master series with sample depth and absent rings by year

Part 4: Bar plot of Master Dating Series

Part 5: Correlation by segment of each series with Master

Part 6: Potential problems: low correlation, divergent year-to-year changes, absent rings, outliers

Part 7: Descriptive statistics

RUN CONTROL OPTIONS SELECTED VALUE

1 Cubic smoothing spline 50% wavelength cutoff for filtering

32 years

2 Segments examined are 50 years lagged successively by 25 years

3 Autoregressive model applied A Residuals are used in master dating series and testing

4 Series transformed to logarithms Y Each series log-transformed for master dating series and testing

5 CORRELATION is Pearson (parametric, quantitative)

Critical correlation, 99% confidence level .3281

6 Master dating series saved N

7 Ring measurements listed Y

8 Parts printed 1234567

9 Absent rings are omitted from master series and segment correlations (Y)

Time span of Master dating series is 1868 to 2015 148 years

Continuous time span is 1868 to 2015 148 years

Portion with two or more series is 1873 to 2015 143 years

>> 276A 1924 absent in 2 of 6 series, but is not usually narrow: master index is 1.449

>> 276B 1924 absent in 2 of 6 series, but is not usually narrow: master index is 1.449

>> 277A 1991 absent in 2 of 22 series, but is not usually narrow: master index is -.166

>> 277B 1991 absent in 2 of 22 series, but is not usually narrow: master index is -.166

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*C\* Number of dated series 22 \*C\*

\*O\* Master series 1868 2015 148 yrs \*O\*

\*F\* Total rings in all series 1923 \*F\*

\*E\* Total dated rings checked 1918 \*E\*

\*C\* Series intercorrelation .568 \*C\*

\*H\* Average mean sensitivity .289 \*H\*

\*A\* Segments, possible problems 6 \*A\*

\*\*\* Mean length of series 87.4 \*\*\*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

ABSENT RINGS listed by SERIES: (See Master Dating Series for absent rings listed by year)

276A 2 absent rings: 1924 2012

276B 4 absent rings: 1924 2001 2002 2012

277A 3 absent rings: 1989 1990 1991

277B 3 absent rings: 1989 1990 1991

12 absent rings .624%

1900 .871 6 1950 .521 14 2000 -.218 22

1901 1.629 6 1951 .953 14 2001 -1.415 22 1

1902 -1.501 6 1952 .648 14 2002 -1.570 22 1

1903 .395 6 1953 -.932 14 2003 -1.096 22

1904 1.758 6 1954 -.728 17 2004 .662 22

1905 .110 6 1955 1.358 18 2005 .723 22

1906 -.274 6 1956 .226 19 2006 -.020 22

1907 -1.365 6 1957 -1.559 20 2007 -.680 22

1908 -.880 6 1958 .095 22 2008 .329 22

1909 .282 6 1959 .018 22 2009 1.476 22

1910 .153 6 1960 .077 22 2010 .432 22

1911 .933 6 1961 -.442 22 2011 .311 22

1912 .404 6 1962 -.236 22 2012 -.506 22 2

1913 -.019 6 1963 -.261 22 2013 .723 22

1914 -2.070 6 1964 -.174 22 2014 1.105 22

1915 -.311 6 1965 -1.384 22 2015 -3.105 11

1916 .400 6 1966 -.894 22

1917 .097 6 1967 .066 22

1868 -1.203 1 1918 -1.701 6 1968 .299 22

1869 -4.365 1 1919 .744 6 1969 -.188 22

1870 .572 1 1920 1.272 6 1970 .254 22

1871 .090 1 1921 1.580 6 1971 .617 22

1872 .588 1 1922 1.639 6 1972 .744 22

1873 1.037 2 1923 .696 6 1973 .029 22

1874 -.184 2 1924 1.449 6 2<< 1974 1.003 22

1875 .561 2 1925 .175 6 1975 .978 22

1876 -1.442 2 1926 -.040 6 1976 .602 22

1877 2.248 3 1927 .000 7 1977 1.070 22

1878 1.499 4 1928 -.532 7 1978 .830 22

1879 1.039 5 1929 -1.460 7 1979 .154 22

1880 .392 5 1930 -.074 7 1980 1.208 22

1881 .765 5 1931 -.719 7 1981 -.534 22

1882 -1.886 5 1932 -.526 7 1982 .253 22

1883 -1.207 5 1933 -1.213 7 1983 -1.783 22

1884 -1.375 5 1934 -.633 7 1984 -1.298 22

1885 .007 5 1935 .567 7 1985 -.217 22

1886 .024 6 1936 -.351 7 1986 -.163 22

1887 -.217 6 1937 -1.067 9 1987 -.053 22

1888 -1.312 6 1938 -.388 9 1988 -1.494 22

1889 .018 6 1939 .096 10 1989 -1.309 22 2

1890 -1.412 6 1940 .035 10 1990 -.882 22 2

1891 -.498 6 1941 .656 12 1991 -.166 22 2<<

1892 .318 6 1942 .704 12 1992 .402 22

1893 -.053 6 1943 -.116 12 1993 .165 22

1894 .878 6 1944 .079 13 1994 .631 22

1895 1.356 6 1945 .383 14 1995 .673 22

1896 2.180 6 1946 -.044 14 1996 .607 22

1897 1.482 6 1947 .887 14 1997 .930 22

1898 -.775 6 1948 -.722 14 1998 1.347 22

1899 -.494 6 1949 -.504 14 1999 .671 22

PART 5: CORRELATION OF SERIES BY SEGMENTS: VMC1235\_ACSA\_Corr6-50 14:22 Tue 17 Jan 2017 Page 5

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Correlations of 50-year dated segments, lagged 25 years

Flags: A = correlation under .3281 but highest as dated; B = correlation higher at other than dated position

Seq Series Time\_span 1850 1875 1900 1925 1950 1975

1899 1924 1949 1974 1999 2024

--- -------- --------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----

1 244A 1954 2015 .44 .48

2 244B 1957 2015 .36 .69

3 246A 1954 2014 .71 .63

4 246B 1955 2014 .64 .63

5 256B 1958 2015 .23B .68

6 257A 1956 2015 .44 .85

7 257B 1954 2015 .39 .82

8 258A 1878 2014 .63 .42 .26A .46 .56

9 258B 1886 2014 .72 .63 .36 .61 .61

10 259A 1877 2014 .72 .61 .52 .63 .60

11 259B 1879 2014 .72 .62 .41B .50 .53

12 264A 1941 2014 .56 .60 .51

13 264B 1927 2015 .53 .56 .55

14 266A 1937 2015 .39 .46 .81

15 266B 1944 2015 .30A .25B .54

16 267A 1939 2014 .51 .55 .43

17 267B 1937 2014 .61 .59 .53

18 276A 1873 2014 .64 .65 .67 .45 .62 .56

19 276B 1868 2014 .74 .75 .57 .49 .61 .50

20 277A 1941 2015 .54 .57 .77

21 277B 1945 2015 .48 .50 .69

22 256A 1958 2015 .25A .69

Av segment correlation .69 .70 .59 .46 .50 .62

PART 6: POTENTIAL PROBLEMS: VMC1235\_ACSA\_Corr6-50 14:22 Tue 17 Jan 2017 Page 5

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For each series with potential problems the following diagnostics may appear:

[A] Correlations with master dating series of flagged 50-year segments of series filtered with 32-year spline,

at every point from ten years earlier (-10) to ten years later (+10) than dated

[B] Effect of those data values which most lower or raise correlation with master series

Symbol following year indicates value in series is greater (>) or lesser (<) than master series value

[C] Year-to-year changes very different from the mean change in other series

[D] Absent rings (zero values)

[E] Values which are statistical outliers from mean for the year

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244A 1954 to 2015 62 years Series 1

[B] Entire series, effect on correlation ( .495) is:

Lower 1972< -.033 2002> -.021 1988> -.019 1999< -.016 1989> -.011 1961> -.009 Higher 1983 .031 1955 .020

244A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1954 125 240 163 136 135 169

1960 140 186 169 194 195 149 143 202 220 207

1970 221 219 157 140 178 194 174 246 258 219

1980 258 156 185 142 214 269 325 252 228 242

1990 179 191 245 257 256 211 202 144 137 76

2000 54 24 124 92 143 84 72 39 72 96

2010 74 63 32 85 84 16

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244B 1957 to 2015 59 years Series 2

[B] Entire series, effect on correlation ( .596) is:

Lower 1957> -.063 1973< -.035 1988> -.019 1989> -.014 1962< -.011 1995< -.009 Higher 2015 .173 1983 .034

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1957 +3.1 SD

244B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1957 195 190 206

1960 177 184 149 172 152 151 148 229 246 258

1970 275 262 218 132 245 222 187 266 240 216

1980 215 129 148 75 150 233 246 269 205 204

1990 133 162 179 135 104 80 93 93 93 61

2000 41 18 51 89 151 117 108 62 130 167

2010 124 88 46 92 121 14

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246A 1954 to 2014 61 years Series 3

[B] Entire series, effect on correlation ( .651) is:

Lower 2009< -.035 1974< -.018 2010< -.018 1981> -.018 1966> -.017 2011> -.013 Higher 1983 .053 1988 .024

246A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1954 195 284 207 150 196 181

1960 164 164 151 168 184 130 233 261 278 268

1970 264 216 238 194 203 277 309 337 327 267

1980 332 275 275 157 158 216 259 229 149 163

1990 209 243 199 238 228 274 170 187 215 156

2000 104 35 40 93 157 140 130 107 145 109

2010 60 179 128 161 160

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246B 1955 to 2014 60 years Series 4

[B] Entire series, effect on correlation ( .607) is:

Lower 1978< -.041 1957> -.031 2010< -.020 1977< -.015 2009< -.014 1981> -.012 Higher 1983 .068 1988 .047

246B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1955 314 258 207 218 176

1960 165 193 153 170 155 101 193 319 352 369

1970 379 388 452 385 367 349 310 261 183 212

1980 278 250 252 154 205 216 237 267 159 177

1990 187 178 182 173 204 267 164 211 251 209

2000 91 52 25 58 124 196 120 86 116 109

2010 54 103 106 108 170

====================================================================================================================================

256B 1958 to 2015 58 years Series 5

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1958 2007 7 -.08 -.09 .00 -.25 -.16 .08 -.17 -.16 .01 .27 .23|-.01 .14 .01 .18 .15 -.10 .30\*-.16 - -

[B] Entire series, effect on correlation ( .558) is:

Lower 1958< -.123 1976< -.020 1988> -.017 2007> -.015 1983> -.014 1966> -.007 Higher 2015 .298 1981 .009

1958 to 2007 segment:

Lower 1958< -.153 1976< -.026 2007> -.022 1988> -.014 1966> -.010 2005< -.009 Higher 1981 .032 1989 .025

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1958 -6.4 SD

256B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 196 224

1960 259 246 224 260 272 218 273 365 388 232

1970 312 270 253 259 228 231 108 117 99 48

1980 92 42 55 46 55 73 36 74 59 16

1990 5 34 81 132 133 140 103 119 103 93

2000 95 65 43 65 91 79 96 144 136 177

2010 181 136 152 176 236 18

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257A 1956 to 2015 60 years Series 6

[B] Entire series, effect on correlation ( .708) is:

Lower 1957> -.075 1956> -.018 1969> -.014 1961> -.012 1962< -.010 1958< -.009 Higher 2015 .236 1983 .017

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1957 +3.1 SD

257A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1956 227 218 145 115

1960 130 214 144 96 72 74 127 243 276 365

1970 341 325 332 341 343 304 255 284 289 238

1980 232 163 168 111 90 117 107 160 145 128

1990 134 187 172 211 253 213 218 194 247 260

2000 135 65 33 57 170 156 118 96 138 169

2010 128 135 122 155 143 19

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257B 1954 to 2015 62 years Series 7

[B] Entire series, effect on correlation ( .688) is:

Lower 1957> -.047 1954> -.021 1955< -.017 1989> -.011 1988> -.011 1969> -.010 Higher 2015 .214 1983 .016

257B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1954 189 154 157 163 112 76

1960 82 98 54 76 74 64 82 191 216 256

1970 224 191 267 277 249 246 200 199 210 156

1980 166 109 128 70 65 67 57 69 68 101

1990 97 157 185 124 214 204 144 118 166 147

2000 85 29 18 58 131 183 153 98 100 156

2010 91 78 64 150 153 13

====================================================================================================================================

258A 1878 to 2014 137 years Series 8

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1925 1974 0 .06 -.02 .20 .02 .11 .23 .24 .03 -.06 .02 .26\*-.18 -.16 .09 -.02 -.08 -.19 -.30 .14 -.17 -.25

[B] Entire series, effect on correlation ( .502) is:

Lower 1902> -.026 1935< -.016 1937< -.016 1977< -.015 1957> -.014 1923< -.014 Higher 1983 .021 1898 .020

1925 to 1974 segment:

Lower 1935< -.058 1957> -.047 1956> -.031 1967< -.027 1937< -.021 1964< -.018 Higher 1948 .040 1947 .032

[C] Year-to-year changes diverging by over 4.0 std deviations:

1937 1938 5.2 SD

[E] Outliers 3 3.0 SD above or -4.5 SD below mean for year

1936 -4.8 SD; 1937 -8.0 SD; 1957 +3.2 SD

258A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1878 264 256

1880 149 123 61 60 45 65 65 95 72 108

1890 72 95 111 114 127 139 170 171 94 91

1900 130 131 107 123 118 95 90 78 75 85

1910 92 99 89 81 59 65 87 74 63 81

1920 107 80 76 49 86 90 75 63 54 45

1930 50 45 42 28 32 20 10 3 23 37

1940 32 36 36 30 31 31 31 56 38 33

1950 45 49 79 57 53 73 104 88 86 92

1960 92 74 76 81 60 62 65 61 73 101

1970 110 114 151 126 167 152 204 140 220 178

1980 184 148 176 97 110 151 220 253 110 102

1990 122 142 132 97 85 58 97 110 127 103

2000 80 53 51 22 38 48 18 26 33 75

2010 65 38 27 75 82

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258B 1886 to 2014 129 years Series 9

[B] Entire series, effect on correlation ( .625) is:

Lower 1920< -.015 1957> -.014 1945< -.013 1941< -.012 1948> -.010 1907> -.009 Higher 1902 .035 1914 .018

258B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1886 57 66 52 61

1890 55 64 88 87 112 104 107 111 81 90

1900 120 123 70 108 154 104 109 110 118 114

1910 122 126 111 103 81 100 108 99 82 116

1920 90 87 100 84 82 73 68 68 49 38

1930 39 37 42 30 25 48 33 28 28 27

1940 26 19 19 13 15 11 21 47 46 47

1950 66 74 82 46 51 102 76 66 62 66

1960 72 84 71 81 66 58 42 49 56 84

1970 92 108 190 203 222 210 211 163 133 111

1980 126 99 108 79 41 81 76 93 43 31

1990 49 49 68 78 73 56 88 99 103 65

2000 63 37 34 20 42 45 24 21 26 70

2010 70 45 38 60 49

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259A 1877 to 2014 138 years Series 10

[B] Entire series, effect on correlation ( .631) is:

Lower 1914> -.027 1948> -.017 2001> -.015 1954> -.009 1965> -.009 1999> -.007 Higher 1882 .019 1957 .012

259A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1877 270 204 161

1880 143 146 91 99 111 122 100 76 62 109

1890 81 99 108 85 112 136 135 121 73 86

1900 87 106 61 81 100 69 54 36 34 43

1910 43 38 43 33 37 42 51 40 12 30

1920 57 72 62 64 64 30 33 29 27 14

1930 29 23 21 25 44 64 42 32 39 64

1940 61 83 83 67 85 119 105 110 121 72

1950 159 106 83 49 111 124 134 48 77 65

1960 65 47 75 87 87 112 127 151 153 111

1970 150 161 180 179 257 239 225 237 260 276

1980 258 162 144 87 102 170 153 152 61 51

1990 89 68 114 124 131 102 131 142 164 208

2000 125 142 93 117 156 149 93 94 108 131

2010 81 42 17 33 68

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259B 1879 to 2014 136 years Series 11

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1925 1974 -4 -.14 -.09 .25 .05 -.14 -.15 .47\* .17 -.11 -.27 .41| .18 -.02 -.26 .07 .32 .07 -.36 .11 -.02 -.10

[B] Entire series, effect on correlation ( .550) is:

Lower 1961< -.018 1989> -.015 1988< -.014 1953> -.013 2001> -.009 2003> -.009 Higher 1882 .016 1983 .013

1925 to 1974 segment:

Lower 1961< -.054 1953> -.052 1954> -.024 1952< -.024 1934> -.022 1935< -.011 Higher 1957 .064 1974 .032

[C] Year-to-year changes diverging by over 4.0 std deviations:

1988 1989 5.7 SD

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1988 -8.0 SD

259B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1879 207

1880 170 163 89 104 109 125 124 92 83 115

1890 62 79 83 68 119 115 135 97 62 76

1900 78 88 52 72 79 64 57 38 35 49

1910 49 44 37 45 29 45 32 23 7 32

1920 56 95 84 61 55 31 42 36 42 34

1930 56 32 35 36 57 47 36 20 33 47

1940 49 65 80 61 60 72 76 75 52 66

1950 120 96 56 75 110 128 102 49 75 65

1960 81 40 105 121 116 105 128 146 163 144

1970 166 179 183 161 243 234 234 233 244 256

1980 271 187 185 114 116 165 145 122 47 147

1990 132 111 137 149 159 127 129 126 147 174

2000 120 135 112 184 186 184 97 109 180 215

2010 155 96 58 70 83

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264A 1941 to 2014 74 years Series 12

[B] Entire series, effect on correlation ( .524) is:

Lower 2000> -.039 2004< -.033 1941< -.023 1988> -.015 1987< -.015 1989> -.013 Higher 1957 .021 1965 .021

264A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 207 235 215 198 247 228 288 200 143

1950 194 242 217 137 141 159 114 100 189 178

1960 220 171 170 135 135 89 122 143 152 183

1970 197 229 229 241 214 198 165 219 256 167

1980 204 85 151 90 68 100 63 47 69 95

1990 82 129 129 82 90 79 92 101 91 58

2000 109 59 49 46 38 66 52 35 76 70

2010 38 63 47 68 89

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264B 1927 to 2015 89 years Series 13

[B] Entire series, effect on correlation ( .528) is:

Lower 1961< -.047 1993< -.029 2007< -.016 1936> -.012 1973> -.010 1937> -.007 Higher 2015 .030 1957 .017

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1961 -5.1 SD

264B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 33 33 10

1930 61 41 24 33 51 81 145 137 128 162

1940 122 291 170 195 216 177 158 187 85 99

1950 166 183 177 74 136 245 112 73 199 156

1960 154 57 134 110 133 91 121 138 110 121

1970 135 142 121 167 157 166 115 123 131 121

1980 151 59 102 68 61 59 52 47 35 73

1990 71 130 128 27 104 149 129 123 104 107

2000 101 61 86 59 87 128 115 30 81 112

2010 112 153 117 148 114 9

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266A 1937 to 2015 79 years Series 14

[B] Entire series, effect on correlation ( .617) is:

Lower 1957> -.038 1937> -.025 1954< -.024 1947< -.023 1988> -.017 1950< -.013 Higher 2015 .161 1983 .017

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1937 +3.2 SD

266A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 346 223 203

1940 204 215 265 217 269 253 162 110 89 89

1950 87 100 103 106 63 130 136 146 145 135

1960 183 167 187 147 183 131 140 169 203 148

1970 206 264 250 214 242 211 169 248 202 157

1980 203 108 134 83 92 110 133 96 98 54

1990 64 103 90 53 81 132 113 145 144 135

2000 84 79 44 54 113 94 78 51 76 117

2010 82 97 90 87 109 21

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266B 1944 to 2015 72 years Series 15

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1944 1993 0 .00 -.23 .25 -.13 .04 -.13 .07 .08 .14 .03 .30\* .02 -.21 -.03 .24 .10 .03 -.12 -.05 .11 .08

1950 1999 -8 -.01 -.16 .41\*-.10 .06 -.15 .00 .09 .11 .01 .25|-.10 -.26 .03 .23 .15 .06 -.06 -.14 .05 .11

[B] Entire series, effect on correlation ( .463) is:

Lower 1996< -.061 1988> -.050 1956< -.033 1985< -.015 1946> -.014 1955< -.011 Higher 2015 .167 1983 .021

1944 to 1993 segment:

Lower 1988> -.093 1956< -.043 1985< -.026 1946> -.021 1955< -.020 1947< -.018 Higher 1983 .064 1957 .034

1950 to 1999 segment:

Lower 1988> -.090 1996< -.075 1956< -.019 1985< -.018 1955< -.014 1997< -.013 Higher 1983 .061 1957 .032

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1946 +3.1 SD; 1988 +4.0 SD

266B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 247 291 345 210 187 153

1950 177 187 158 112 83 110 52 72 158 100

1960 136 119 152 170 148 114 98 111 132 103

1970 134 168 161 141 159 134 157 152 159 134

1980 172 140 179 106 104 89 131 150 168 87

1990 110 116 103 97 95 138 66 80 109 125

2000 96 98 61 77 125 115 135 98 123 181

2010 119 118 90 104 120 31

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267A 1939 to 2014 76 years Series 16

[B] Entire series, effect on correlation ( .499) is:

Lower 1939< -.040 1988> -.026 1965> -.024 2014< -.023 1970< -.020 1962> -.015 Higher 1957 .066 1953 .029

267A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1939 198

1940 280 333 260 224 260 298 206 244 177 210

1950 175 240 198 119 102 208 142 80 194 175

1960 172 163 215 161 184 170 122 153 130 94

1970 74 104 143 109 145 192 208 202 171 140

1980 190 103 124 69 45 34 40 68 64 56

1990 27 37 53 42 47 88 111 98 93 103

2000 56 52 64 59 93 90 64 52 62 100

2010 113 86 68 103 77

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267B 1937 to 2014 78 years Series 17

[B] Entire series, effect on correlation ( .557) is:

Lower 2008< -.019 1989< -.016 1999< -.014 1955< -.014 1988> -.014 1968< -.012 Higher 1957 .035 1953 .024

267B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 36 22 41

1940 26 181 199 162 214 247 220 206 163 132

1950 175 244 159 59 45 78 76 40 122 106

1960 159 155 142 118 145 112 86 118 88 63

1970 68 128 161 134 203 232 223 248 180 137

1980 156 122 134 79 66 68 43 70 57 14

1990 19 44 82 82 83 82 82 110 103 61

2000 62 62 63 54 61 102 79 71 64 117

2010 95 88 84 105 98

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276A 1873 to 2014 142 years Series 18

[B] Entire series, effect on correlation ( .511) is:

Lower 1924< -.051 1888> -.014 1898> -.013 1972< -.011 1894< -.011 1937> -.010 Higher 1902 .041 1957 .016

[D] 2 Absent rings: Year Master N series Absent

1924 1.449 6 2 >> WARNING: Ring is not usually narrow

2012 -.506 22 2

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1888 +3.3 SD; 1924 -5.1 SD

276A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1873 261 219 238 196 333 297 273

1880 231 249 172 168 142 184 191 219 209 174

1890 163 138 163 148 137 161 187 150 139 131

1900 172 203 92 115 157 128 98 76 93 107

1910 74 107 96 86 40 56 59 59 36 60

1920 69 70 63 51 0 29 20 13 14 23

1930 45 45 71 47 53 136 132 184 150 202

1940 204 265 222 247 139 127 133 191 172 194

1950 237 326 358 205 211 331 247 91 365 229

1960 174 254 213 195 233 208 291 254 285 273

1970 298 279 223 222 288 266 260 363 268 245

1980 363 246 291 175 215 252 188 91 44 71

1990 102 108 104 84 133 105 118 102 142 54

2000 59 27 34 42 59 32 49 79 73 73

2010 39 31 0 38 66

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276B 1868 to 2014 147 years Series 19

[\*] Early part of series cannot be checked from 1868 to 1872 -- not matched by another series

[B] Entire series, effect on correlation ( .550) is:

Lower 1924< -.087 1937> -.010 1987< -.008 1967< -.008 1936> -.008 1999< -.007 Higher 1882 .025 1957 .018

[D] 4 Absent rings: Year Master N series Absent

1924 1.449 6 2 >> WARNING: Ring is not usually narrow

2001 -1.415 22 1

2002 -1.570 22 1

2012 -.506 22 2

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1924 -5.1 SD

276B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1868 62 37

1870 113 108 128 178 142 169 109 211 194 160

1880 164 195 126 147 146 170 173 138 128 135

1890 131 186 158 185 188 203 296 239 140 125

1900 148 176 130 127 153 109 106 99 104 120

1910 89 130 90 66 36 46 49 67 38 68

1920 55 68 64 46 0 28 17 19 18 14

1930 31 33 50 38 37 119 146 179 208 210

1940 160 157 135 68 91 109 86 187 169 158

1950 221 279 301 207 190 393 271 129 260 199

1960 164 205 138 126 133 105 118 93 85 109

1970 116 130 151 123 162 194 182 174 168 167

1980 191 153 148 93 79 98 76 43 30 50

1990 93 79 82 78 74 54 67 64 71 29

2000 30 0 0 20 32 43 20 36 48 41

2010 28 15 0 35 61

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277A 1941 to 2015 75 years Series 20

[B] Entire series, effect on correlation ( .608) is:

Lower 1949> -.023 1941< -.013 1965> -.013 1991< -.012 1953> -.011 1992< -.010 Higher 2015 .077 1955 .014

[D] 3 Absent rings: Year Master N series Absent

1989 -1.309 22 2

1990 -.882 22 2

1991 -.166 22 2 >> WARNING: Ring is not usually narrow

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1957 -4.9 SD

277A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 221 268 264 282 230 208 303 146 362

1950 309 269 230 222 218 395 265 68 224 189

1960 186 127 198 196 268 210 169 177 188 120

1970 125 103 152 92 184 221 174 188 130 73

1980 139 79 60 41 57 64 49 56 31 0

1990 0 0 13 33 54 80 105 110 140 129

2000 105 82 65 68 173 133 150 114 108 164

2010 136 122 65 83 86 15

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277B 1945 to 2015 71 years Series 21

[B] Entire series, effect on correlation ( .556) is:

Lower 1991< -.021 1953> -.017 1966< -.008 1989< -.008 1967< -.008 1950< -.008 Higher 2015 .025 2009 .015

[D] 3 Absent rings: Year Master N series Absent

1989 -1.309 22 2

1990 -.882 22 2

1991 -.166 22 2 >> WARNING: Ring is not usually narrow

277B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 339 230 542 166 302

1950 225 223 205 238 192 301 164 147 363 313

1960 242 195 177 179 228 156 108 120 167 138

1970 141 206 206 120 124 168 139 177 106 81

1980 142 96 119 65 61 64 72 50 25 0

1990 0 0 18 36 30 28 32 70 79 54

2000 35 31 18 24 71 57 64 46 80 165

2010 118 88 34 90 85 10

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256A 1958 to 2015 58 years Series 22

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1958 2007 0 -.03 -.23 .04 -.11 -.14 .04 -.06 -.21 -.02 .23 .25\* .08 .04 -.05 .08 .15 .11 .22 -.02 - -

[B] Entire series, effect on correlation ( .593) is:

Lower 1958< -.091 1975< -.029 1991< -.015 1988> -.015 2002> -.012 2005< -.010 Higher 2015 .310 2004 .010

1958 to 2007 segment:

Lower 1958< -.122 1975< -.045 1991< -.021 2002> -.017 2005< -.016 2007> -.013 Higher 2004 .043 1981 .030

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1958 -5.7 SD

256A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 208 249

1960 245 218 215 245 263 207 304 483 518 379

1970 311 372 393 257 284 88 60 66 72 49

1980 58 19 23 14 31 37 21 28 23 11

1990 10 3 45 73 59 64 59 87 101 121

2000 83 59 81 58 151 99 87 107 97 144

2010 155 119 117 130 171 17

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PART 7: DESCRIPTIVE STATISTICS: VMC1235\_ACSA\_Corr6-50 14:22 Tue 17 Jan 2017 Page 6

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Corr //-------- Unfiltered --------\\ //---- Filtered -----\\

No. No. No. with Mean Max Std Auto Mean Max Std Auto AR

Seq Series Interval Years Segmt Flags Master msmt msmt dev corr sens value dev corr ()

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1 244A 1954 2015 62 2 0 .495 1.63 3.25 .705 .790 .284 2.71 .538 .088 1

2 244B 1957 2015 59 2 0 .596 1.55 2.75 .688 .775 .298 2.49 .509 -.021 1

3 246A 1954 2014 61 2 0 .651 1.96 3.37 .688 .740 .237 2.66 .533 .104 1

4 246B 1955 2014 60 2 0 .607 2.06 4.52 .952 .853 .254 2.63 .472 .009 1

5 256B 1958 2015 58 2 1 .558 1.46 3.88 .930 .845 .337 2.42 .421 -.091 1

6 257A 1956 2015 60 2 0 .708 1.81 3.65 .841 .831 .255 2.35 .357 .065 2

7 257B 1954 2015 62 2 0 .688 1.33 2.77 .653 .755 .302 2.48 .382 .054 1

8 258A 1878 2014 137 5 1 .502 .89 2.64 .504 .828 .251 2.57 .445 .052 1

9 258B 1886 2014 129 5 0 .625 .76 2.22 .416 .877 .221 2.62 .365 .001 1

10 259A 1877 2014 138 5 0 .631 .99 2.76 .581 .855 .269 2.67 .460 -.011 1

11 259B 1879 2014 136 5 1 .550 1.02 2.71 .579 .860 .263 2.44 .319 -.046 2

12 264A 1941 2014 74 3 0 .524 1.36 2.88 .672 .829 .261 2.68 .567 .002 1

13 264B 1927 2015 89 3 0 .528 1.12 2.90 .529 .511 .375 2.71 .482 -.040 1

14 266A 1937 2015 79 3 0 .617 1.40 3.46 .647 .793 .250 2.47 .427 -.053 1

15 266B 1944 2015 72 3 2 .463 1.32 3.45 .496 .674 .247 2.62 .542 .019 1

16 267A 1939 2014 76 3 0 .499 1.32 3.33 .712 .827 .269 2.48 .475 .047 1

17 267B 1937 2014 78 3 0 .557 1.10 2.48 .596 .790 .290 2.89 .508 .133 1

18 276A 1873 2014 142 6 0 .511 1.54 3.65 .920 .823 .311 2.61 .415 -.013 1

19 276B 1868 2014 147 6 0 .550 1.16 3.93 .708 .825 .329 2.79 .450 .009 1

20 277A 1941 2015 75 3 0 .608 1.45 3.95 .877 .735 .361 2.57 .388 -.032 1

21 277B 1945 2015 71 3 0 .556 1.29 5.42 1.006 .676 .400 2.74 .535 .077 1

22 256A 1958 2015 58 2 1 .593 1.39 5.18 1.236 .892 .345 2.55 .394 -.097 1

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Total or mean: 1923 72 6 .568 1.28 5.42 .696 .798 .289 2.89 .446 .009

- = [ COFECHA VMCSMCOF ] = -