

FINAL PROGRESS REPORT FIRST YEAR

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History of the Project

The desirability of having an independent study made of tree-ring specimens from the Central and Northern Plains has long been recognized by workers in the area. Such a study became possible in the Spring of 1964 when the Laboratory of Tree-Ring Research approached the Smithsonian Institution, River Basin Surveys of Lincoln, Nebraska and the Midwest Regional Office of the National Park Service, Omaha, Nebraska on the feasibility of developing and financing a program of study for material from the Middle Missouri area of South Dakota. It was proposed that a completely independent attempt be made to construct modern chronologies for the Middle Missouri by the Laboratory of Tree-Ring Research, The University of Arizona, Tucson, Arizona. If this project was successfully completed, provision was made to expand the study to include the use of archeologically-derived specimens in an attempt to extend any chronology derived and to obtain dates for the wood from the archeological sites.

The first phase of this work has now been completed. Cross-dating between specimens has been established and five areally specialized chronologies have been constructed. They cover the

Middle Missouri region from the vicinity of the Big Bend of the Missouri River north to Mobridge, South Dakota and the Cheyenne River into Haakon County, South Dakota (Figure 1).

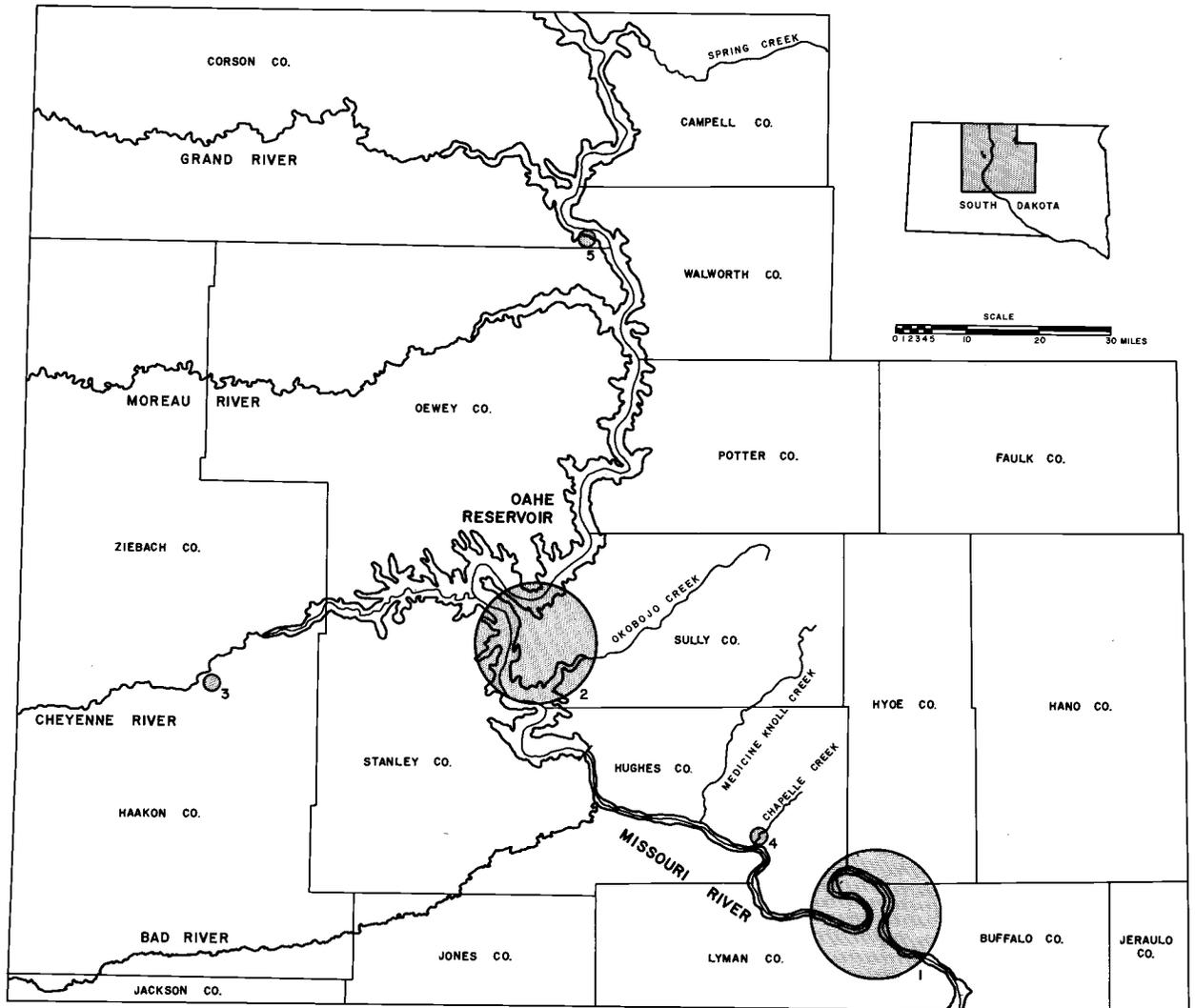
To date, the work on the project has been restricted to specimens collected between 1958 and 1963, primarily through the efforts of the River Basin Surveys. The project has included transportation of one hundred twenty-one specimens, including duplicates, to Tucson, Arizona from Lincoln, Nebraska; preparation of the material for study; detailed analysis of the individual pieces and construction of five specialized chronologies. Part of this work has previously been described by me in two earlier progress reports dated November 2, 1964 and April 30, 1965. A preliminary report on the project was made to the Plains Anthropological Conference in November of 1964.

The five specialized chronologies that have been constructed have been named for the general areas from which they were derived: Big Bend Area, Chapelle Creek Area, Northern Stanley County-Sully County Area, Mobridge Area, and Haakon County-Cheyenne River Area (Figure 1).

A total of one hundred two dated specimens, including duplicates, were used to construct these five chronologies. A detailed discussion of these specimens plus the five pieces for

**Figure 1. Specimen Collection Areas for the Five
Middle Missouri Chronologies**

1. Big Bend Area
2. Northern Stanley County-Sully County Area
3. Haakon County-Cheyenne River Area
4. Chapelle Creek Area
5. Mobridge Area



which tentative dates were derived and fourteen which could not be dated will be given in a later portion of the report.

History of Previous Work in the Area

The earliest attempt to apply the methods of tree-ring analysis to material from the Middle Missouri area of South Dakota was made by the late George F. Will of Bismarck, North Dakota (Will, 1948). Will did not construct a modern chronology for any part of the Missouri River in South Dakota, but attempted to crossdate specimens from three archeological sites in the vicinity of Pierre, South Dakota with a chronology he had constructed for areas of North Dakota, approximately two hundred fifty plus miles distant. It should be noted that Will urged caution in the acceptance or use of the dates he derived because of the distance involved (Will, 1948:68-70).

Will's work has been criticized on several grounds (Bell, 1948; Meleen, 1948; Lehner, 1950; Hurt, 1952). These criticisms include: the distance between the location of his master chronology and the sites for which the dates were obtained, his crossdating juniper specimens from the sites with a master chronology based on oak, and the disagreement of the dates with known archeological relationships. This latter is outside the scope of this report and will not be discussed here.

On the basis of the present study, the first criticism, that of the distance involved, appears to be valid at least to a degree. While crossdating has been noted between the areas for which chronologies have been constructed, its character tends to be less specific and of a more generalized nature as the distance between specimen locations becomes greater.

The second criticism of Will's work, that raised on the grounds of species difference, cannot be adequately evaluated on the basis of work done to the present. A very high degree of crossdating has been observed between juniper and a limited sample of seven specimens of ash from the Middle Missouri area. At the same time, a very poor degree of crossdating has been found between juniper and an even more limited sample of three oak specimens from the area. Two pieces of hackberry have been examined with no crossdating evidenced between it and the other species.

Following Will's early work, the Missouri Basin Chronology Program was established in 1958 to promote chronological investigations including use of tree-ring methods. It was not until the Fall of 1960, however, that any intensive tree-ring studies were undertaken on material collected in the Middle Missouri area. At that time I began a study of the material, the results of which were presented to the University of Nebraska as a Masters thesis in 1961 (Weakly, 1961). A chronology was constructed for the

Middle Missouri based on both modern collections and archeological specimens. The chronology covered the period A.D. 1302 to 1958 and along with it dates for material from eighteen archeological sites were presented (Weakly, 1961). The above chronology was entitled, "The Big Bend Area Tree-Ring Master Chart." It was, however, based on specimens derived from the entire Middle Missouri area lying between Chamberlin, South Dakota and Mobridge, South Dakota. At no point were less than thirty-eight specimens used in its construction. It now appears that this chronology is invalid and that any further use of it should be avoided.

The reasons for the above are two-fold. First, it appears that the original study made in 1960-1961 was not capable of distinguishing all of the double rings in the specimens used. Secondly, the chronology is much too generalized to be effective. Both of these points will be discussed in more detail below, but as the research now stands the earlier work can no longer be used.

The following discussion of the specimen study and construction of the chronologies for this project will go into several of the problems presented above in more detail. Where possible, comparisons of the current study with previous work will be made to help clarify any points which need further discussion.

General

The purpose of this study was to undertake an independent investigation of the feasibility of using tree-ring methods as a means of building chronologies in the Middle Missouri area of South Dakota. Initially, this was done through the establishment of crossdating between samples and then through the construction of five chronologies covering portions of the area. In this manner, the validity of employing tree-ring methods in the Middle Missouri as a chronology building process has been demonstrated. Lastly, the project has allowed a check on work previously done in the region.

On the basis of the above, there is reason to believe that these methods can be extended to the dating of archeologically-derived specimens. It is in this direction that work on the project is now proceeding.

Detailed Discussion

In August of 1964 and twice since that time, specimens have been transferred between the Smithsonian Institution, River Basin Survey Laboratories in Lincoln, Nebraska and the Laboratory of Tree-Ring Research, Tucson, Arizona. Upon their arrival in Tucson, the first problem was preparation of the material for study. This has been a continuing process although the large majority of this

work was completed in the Fall of 1964. Each piece had to be put through a process of sanding, and where necessary, cut to manageable size. The preparation of the individual specimens is a set procedure in which each item is sanded with six grades of sandpaper, coarse to fine, to achieve an adequate surface for study.

At the same time that the foregoing was in progress, a system of records was established. The records consist of an individual card for each specimen and a log made as the study progressed. The individual card has on it the specimen number, species, date collected, provenience, any dates derived, remarks and disposition. The log contains all of the above data with the exception of the disposition and it also includes more detailed remarks as to the quality of the specimen, its condition, and record of the chronology.

Initial Study

To begin with, a group of about twenty specimens selected for apparent size and having the same cutting date, A.D. 1958, were arbitrarily set aside and studied. Each of these specimens was a full cross section of a tree and plots were made of their ring widths. In some instances more than one plot was made of the same piece on another radii. An attempt was then made to cross-date the plots with the result that while some showed a high degree of crossdating, others did not fit as well. At this point,

maps of the Middle Missouri area were obtained and the provenience of each specimen was plotted. Five major clusters or collection areas were noted and the material was sorted by area. A marked improvement in the quality of the crossdating between specimens from within the same collection areas was found after this had been accomplished. The remainder of the sample was then studied within the framework of the five defined areas of collection with the resultant construction of five areally specialized chronologies (Figure 1).

Analysis by Species

Juniperus scopulorum and Juniperus virginiana were both utilized and form the basic chronology. No distinction as to whether a specimen was scopulorum or virginiana was possible since there is no apparent difference in the structure of the wood and such data was not generally included in the initial collection of the material. There were one hundred nine pieces of juniper, including duplicates, in the sample which form the basis of the chronologies that have been constructed. Crossdating between some of the juniper pieces is excellent, especially in very localized areas. This latter is shown by specimens collected from a very small area demonstrating a very high degree of cross-dating while distinct differences may appear across a short distance.

Generally, however, there is at the same time similarity of the chronologies on all specimens from the whole region. The exact implications of the above have not, as yet, been worked out but are still a part of the considerations of the project.

Ash, Fraxinus spp. - Of this species only seven specimens were available in the sample. Of this number, five were dated although one of these is a tentative date. Of the remaining two undated specimens, one was less than twenty years in length and the other was badly damaged. The surprising thing about the ash material is the high quality of crossdating it exhibits with the juniper chronology. This species certainly needs further investigation and more extensive collections should be made from the Middle Missouri area.

Oak, Quercus spp. - Only three specimens of this type were in the collection. Of these only one could be adequately dated against the juniper chronology and it did not crossdate well. The sample is much too small to draw any definite conclusions from it. At present, oak does not appear to be of much use.

Hackberry, Celtis spp. - Two specimens of hackberry were included in the sample neither of which could be dated. Again the sample is much too small to arrive at any definite conclusions.

The foregoing discussion of the work of this project with the various species of wood included in it, in particular the junipers, is pertinent to the earlier discussion of George F. Will's work in this area. The distinct character of the chronology as recorded by the junipers from relatively close areas tends to substantiate the problem of the distance over which Will was trying to work. In general, I doubt that with the present state of knowledge his dates for the three sites in the Pierre vicinity can be accepted on this basis alone. On the matter of his using different species of wood in his dating, little can be added at this point. In all instances, with the exception of the juniper collection, the samples are far too small to make a valid assessment.

Construction of the Chronologies

To the present time, all of the work has been done in skeleton plot form. Each of the five chronologies is based on material from a fairly restricted area and they are covered by a varying number of specimens over their length. They are obviously weaker on the earlier end, but it is hoped this will be changed by the inclusion of archeologically-derived specimens. Generally, it has been much more difficult to distinguish double rings in the first thirty to fifty years of juniper growth. The possible refinement of the chronologies in their earlier portions is the

reason for not reproducing the actual skeleton plots in this report. The accompanying bar graph (Figure 2) shows the manner in which the specimens crossdate for the five chronologies. It does not, however, account for all of the specimens incorporated into them. Those which were dated but not included specifically were omitted from the bar graphs because they were not plotted or were tentative dates. Those that were not plotted were usually either quite short, complacent, duplicates, or some combination of these factors. A table of all of the specimens worked to date is included along with provenience data so that the actual number of specimens supporting each chronology is easily available (Table 1).

In addition to the above reason for not publishing the skeleton plots at this time is the lack of measured indices for the chronologies. This part of the project is provided for in the contract for the coming year and should be a part of the final presentation of the work. It is also possible that a further refinement of the five chronologies may be possible as to specialized area of origin. If this should happen, it would be premature to release them at this time.

One point to be stressed is the apparent discrepancies between the present study of this material and that previously made in 1960-1961 (Weakly, 1961). After the study of the collections had been completed, an attempt was made to compare the new

**Figure 2. Crossdating of Specimens for the
Middle Missouri Chronologies**

1600	1650	1700	1750	1800	1850	1900	1950	
BIG BEND AREA					39LM00-1 39LM00-3 DX63-2 DX60-1 DN58-7 DN58-5 DX58-14 DN58-6 DN58-2(A&B) DN58-4(A&B) DX58-16 DN58-9 DN58-1 DN58-39 DX58-15 DN58-16A		DX58-12 DX58-11	
	39LM00-6							
		DX58-13				DX58-8	DX58-1	
39LM00-5					DX62-4			
	39LM00-4							
	DX62-7							
	39LM00-7				DX62-1			
	39LM00-2							
	DX62-6A		DN58-17					
DX62-2	DX62-5							
	DX62-6B		DN58-18					
	DM59-2A							
DN58-36(A&B)								
DX59-1(A&B)		DM59-8						
	DM59-4							
	DM59-5							
	DN58-37(A&B)							
NORTHERN STANLEY COUNTY- SULLY COUNTY AREA					DM59-3 DM59-9 DM59-7 DN58-7 DW58-11 DW58-10 39SL00-9 39SL00-10A 39SL00-11 DW58-8 DW58-5 39SL00-10B 39SL00-6 DW58-6			
		DN58-40(A&B)		DN58-24 DM59-2B				
	DM59-1		DN58-41A					
HAAKON COUNTY- CHEYENNE RIVER AREA					DN58-15 DN58-12A DN58-10A DN58-12B			
	DN58-34A		DN58-34B					
CHAPELLE CREEK AREA				HD63-L3		HD63-L1		
MOBRIDGE AREA						DN62-1 DN62-2 DN62-3		

TABLE 1

SPECIMENS BY AREA

<u>Specimen Number</u>	<u>Species</u>	<u>Date</u>	<u>Remarks</u>
BIG BEND AREA:			
DN58-1	Juniper	1862P-1958B	
DN58-2A	"	1866P-1958B	Same as DN58-2B
DN58-2B	"	1866P-1958B	Same as DN58-2A
DN58-4A	"	1866P-1958B	Same as DN58-4B
DN58-4B	"	1866P-1958B	Same as DN58-4A
DN58-5	"	1877P-1958B	
DN58-6	"	1869P-1958B	
DN58-7	"	1882P-1958B	
DN58-9	"	1863P-1958B	
DN58-16A	"	1849FP-1958B	
DN58-16B	"	1905FP-1958B	
DN58-17	"	1770FP-1928v	
DN58-18	"	1737FP-1922vv	
DN58-36A	"	1684FP-1880B	Same as DN58-36B
DN58-36B	"	1653P-1805vv	Same as DN58-36A
DN58-37A	"	1688FP-1796vv	Same as DN58-37B
DN58-37B	"	1713FP-1766vv	Same as DN58-37A
DN58-38	"	Not Dated	
DN58-39	"	1861P-1938v	
DX58-1	Ash	1923FP-1956v	
DX58-4	Juniper	? -1958B	Same as DX58-7 and 13
DX58-5	"	1891P-1958B	
DX58-6	"	1920P-1958B	
DX58-7	"	? -1958B	Same as DX58-4 and 13
DX58-8	Ash	1897P-1957B	
DX58-9	Oak	1876P-1958B	Ring Count
DX58-10	"	1872P-1958B	Ring Count
DX58-11	Juniper	1917P-1958B	
DX58-12	"	1924P-1958B	
DX58-13	"	1699P-1958B	Same as DX58-4 and 7
DX58-14	"	1874P-1958B	
DX58-15	"	1852P-1958B	
DX58-16	"	1866P-1958B	
DX59-1A	"	1635FP-1870vv	Same as DX59-1B
DX59-1B	"	1643FP-1751vv	Same as DX59-1A
DX60-1	"	1825P-1959B	
DX62-1	"	1854P-1935B	
DX62-2	"	1631P-1928B	
DX62-3	"	1890P-1937v	
DX62-4	"	1859P-1937v	
DX62-5	"	1674NP-1928B	
DX62-6A	"	1705FP-1928B	
DX62-6B	"	1705FP-1924v	

<u>Specimen Number</u>	<u>Species</u>	<u>Date</u>	<u>Remarks</u>
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BIG BEND AREA (Continued):

DX62-7	Juniper	1702P-1936G	
39LM00-1	"	1854P-1963B	
39LM00-2	"	1691P-1932v	
39LM00-3	"	1851P-1963B	
39LM00-4	"	1685P-1937B	
39LM00-5	"	1643P-1940B	
39LM00-6	"	1707P-1963B	
39LM00-7	"	1676P-1935B	
Misc.-1	"	1900P-1950B	

NORTHERN STANLEY COUNTY-SULLY COUNTY AREA:

DN58-19	Juniper	1909NP-1958B	
DN58-20	"	1900P-1958B	
DN58-21A	"	Not Dated	
DN58-21B	"	1719FP-1956v	Tentative
DN58-22	"	1865NP-1958B	
DN58-23	"	1902NP-1958B	
DN58-24	"	1755FP-1958B	
DN58-25	"	1767FP-1958B	
DN58-26	"	1914FP-1957v	
DN58-27	"	1913NP-1958B	
DN58-28	"	1881FP-1958	Tentative
DN58-29	"	1887FP-1958B	
DN58-30	"	1854FP-1958B	
DN58-31	"	1885NP-1955v	
DN58-32	"	1911NP-1958B	
DN58-33	"	Not Dated	
DN58-40A	"	1693FP-1862vv	Same as DN58-40B
DN58-40B	"	1699FP-1862vv	Same as DN58-40A
DN58-41A	"	1744FP-1848B	
DN58-41B	"	Not Dated	
DW58-1	"	1691P-1875vv	
DW58-2	"	Not Dated	
DW58-3	"	Not Dated	
DW58-5	"	1903P-1958B	
DW58-6	"	1853P-1958B	
DW58-7	"	1921P-1958B	
DW58-8	"	1904P-1958B	
DW58-9	"	1909P-1958B	
DW58-10	Ash	1917NP-1958B	
DW58-11	"	1918FP-1958B	
DW58-12	"	1928FP-1958B	

<u>Specimen Number</u>	<u>Species</u>	<u>Date</u>	<u>Remarks</u>
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NORTHERN STANLEY COUNTY-SULLY COUNTY AREA (Continued):

D39SL00-1	Hackberry	Not Dated	
D39SL00-3	"	Not Dated	
D39SL00-6	Juniper	1869P-1958B	
D39SL00-9	"	1917P-1958B	
D39SL00-10A	"	1906P-1958B	
D39SL00-10B	"	1883P-1958B	
D39SL00-11	"	1904P-1958B	

HAAKON COUNTY-CHEYENNE RIVER AREA:

DN58-10A	Juniper	1871FP-1955vv	
DN58-10B	Ash	Not Dated	
DN58-11	Juniper	1910P-1958B	
DN58-12A	"	1897NP-1945vv	Tentative
DN58-12B	"	1831P-1907vv	
DN58-13	"	Not Dated	
DN58-14A	"	Not Dated	
DN58-14B	Ash	Not Dated	
DN58-15	Juniper	1929P-1958B	
DN58-34A	"	1637FP-1876vv	Same as DN58-34B
DN58-34B	"	1742FP-1884v	Same as DN58-34A
DN58-35	"	Not Dated	

MOBRIDGE AREA:

DN62-1	Juniper	1937P-1962B	
DN62-2	"	1918P-1962B	
DN62-3	"	1898P-1962B	

CHAPELLE CREEK AREA:

HD63-L1	Juniper	1866P-1963B	
HD63-L2	"	1738P-1916vv	
HD63-L3	"	1807P-1936B	

ORIGIN NOT KNOWN:

DX63-1	Juniper	1919P-1963B	
DX63-2	"	1873P-1963B	
DN63-1	Oak	1891P-1963B	

work with copies of the work done previously by myself. The result has been an increasing awareness of problems with the earlier work. It has been extremely difficult to crossdate the new chronologies with the plots of the earlier one. This has also been true in attempts to compare the work on individual specimens. The apparent reason for this is the inclusion in the earlier work of unrecognized double rings plus a quite different approach in the method of construction of the skeleton plots. Another factor which obviously plays a role is the much larger size of the sample included in the present study which has certainly been useful in so far as refining the chronologies. For these reasons, the 1961 chronology must be considered invalid although, as work on the project continues, further studies of these problems will be made. What total effect the current project will have on dates previously determined cannot be stated at this time. There are some indications that any actual error may be small; however, there is as yet no verification of this and the final answer must await the outcome of the study of the archeological material.

SUMMARY AND CONCLUSIONS

I feel that several points should receive further stress at this time. The first of these is the validity of the chronologies which have been constructed. The high quality of the crossdating

to the point that plots for one specimen are nearly identical to those of others, especially in very restricted localities, indicates a high degree of reliability. Actual comparisons of the measured indices as they become available will be very useful to further demonstrate this. It is possible that the present five chronologies can be further refined as to locality and that this may even be advisable, but it does not appear so at the present time. The work that has been done up to now has been very encouraging.

As to the use of juniper for the construction of tree-ring chronologies in the Middle Missouri area, this problem has been very satisfactorily answered in the affirmative. Not only has this been done on the internal evidence of the crossdating between specimens of juniper, but it is further substantiated by the excellent crossdating between juniper and ash. This latter is admittedly from a very limited sample. I definitely feel that in the future additional collections of this species should be made and further work done on it.

At present, the possibilities of dating archeologically-derived wood specimens of juniper and ash look very good. It is hoped that as the project continues this can be verified. Work has now begun in this direction and if progress can continue as at present, the chronologies can be lengthened and strengthened, and valid dates can be derived for archeological specimens.

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