

November 21, 1917.

Prof. Charles R. Cross,
100 Upland Road,
Brookline, Mass.

Dear Prof. Cross:

Noticing the two leaflets which you handed me at the meeting of the Astronomical Society, I am reminded, that while there is a possibility of getting funds from the University here for certain astronomical photographs and other funds possibly from other sources for certain studies of tree rings, yet I would be a gainer, and perhaps this institution through me, if I were able to attend the American Association meeting in December.

Are there any funds that could be devoted to that purpose?

Please understand that I am asking this without expecting a favorable answer, yet I do feel that in this case I might contribute an article of some kind, - perhaps a real description of the Optical Periodigraph, - taking the instrument along with me. It is possible that this would interest the Physics section.

In this matter I clearly realize the greatest handicap of a location like this, is the difficulty of attending scientific meetings. I have always looked forward to the time when I might attend them but the expectation of an observatory here rather deprives me of anticipation of moving to some other town where I could reach the meeting with more ease.

It is out in this comparatively new country that an important part of the scientific work of the future must necessarily be done. In due time we are going to have great collections here not only of Archaeological relics but of all sorts of Natural History specimens. The contact that we may get with the scientific men at such meetings would help, I am sure, very greatly in advancing these collections.

Sincerely yours,

Dean, College of Letters, Arts,
and Sciences.

AED/S.

UNIVERSITY OF ARIZONA
TUCSON
COLLEGE OF LETTERS, ARTS AND SCIENCES
OFFICE OF THE DEAN

December 19, 1917.

Prof. F. E. Clements,
Carnegie Institution,
Washington, D. C.

Dear Prof. Clements:

If I have not answered your letter of November 26, with expressions of keen appreciation of your attitude in the matter of work on weather cycles, it is because I had the notion that you were starting out here at about that time and my letter would not reach you. I have at the present time certain sources which might be drawn on for helping work of that or similar character.

In the plan which I sent you provision is made for completing the work and reduction on the present measures. How would it do to request from the committee on research of which Prof. Cross and Prof. Pickering are members, that a sum of \$250.00 be appropriated for extending the Sequoia record from a length of 2200 years to a length of 3000 or more if possible? Such an expenditure would have to be made in transportation probably of myself to the Sequoia Groves east of Fresno, in which both Huntington and I have done work.

There are really two ^{to procure} items in that extension which I wish to cover. First, a number of samples of younger trees covering particularly the year 1581, where there is a ring whose identity I still hold in some doubt. Second, the extension of the actual length of the Sequoia record from about 280 B. C. to a time as far back as can reasonably be done. I think both of these could be done in a week's visit to the grove with funds for paying for hauling and for sawing in accordance with the general plan which I used in 1915. At that time I obtained fifteen samples of Sequoias in the form of bars of wood, extending from the center of the trees to the outside, at an expense of less than \$5.00 each. That included transportation only and didn't include any hotel or restaurant expenses, and the transportation was on that occasion from Los Angeles. Transportation from here would be somewhat more but I am confident that the ~~same~~ ^{sum} would be well spent in the results which it would produce.

I am thinking of writing to Prof. Cross to-day so that he will get it before Christmas, along the general lines I have here indicated. The Steward Observatory has

Prof. F. E. C. - 2

been organized and there will be some small appropriations for research work carried along under its auspices. It may be that its ~~money~~ ^{name} can be associated with the weather cycle work.

I shall have some definite plans with regard to the latter to talk over with you when you come.

Sincerely yours,

Dean, College of Letters, Arts
and Sciences.

AED/S.

December 19, 1917.

Prof. Charles R. Cross,
100 Upland Road,
Brookline, Mass.

Dear Prof. Cross:

About a month ago I wrote you a letter which I did not send because I thought at that time there was very little possibility of my being able to formulate some definite request along the lines referred to. I will inclose that letter with this one ~~but~~ recognizing that it is too late even at best, to expect any result in regard to transportation and feeling anyway a little diffident about making such a request.

I am at the present moment entering a request along lines which I have just written Dr. F. E. Clements, who is now in Washington in connection with the Carnegie Institution, but who expects to return here in the next few weeks.

He may be in close touch with you in regard to expenditures along these lines ~~and~~ ^{but} he has written me that he will use a part of his budget to complete some of the work on tree rings and weather cycles, which I have in hand and which has been partly done by the appropriation of \$200.00 from the Elizabeth Thompson Science Fund (Grant No. 189), but which he wishes to bring to a conclusion. He is anxious to get some immediate results out of the material already in hand, but it has seemed to me that in this connection it would be very admirable to make a further small expenditure of about \$250.00 in order to extend the length of time studied in this record of tree growth from my maximum time of 2200 years up to 3000 years or over, and at the same time to get further material in order to remove a certain uncertainty as to the annual character of a faint ring appearing in the neighborhood of the year 1581.

I think the sum mentioned would probably provide for both these bits of work. It would mean a trip by myself to the Sequoia forest east of Fresno which I visited before, and probably from five to seven days tramping around the country, and the paying of sawyers and for hauling and packing as in my former trip in 1915.

The proposed expenditure should also cover freight and some expenses connected with the minute examination of specimens brought back; the expense of measuring perhaps a

Prof. C. H. C. - 2.

very considerable number of rings and the clerical work after that of getting lists in shape.

I am trying to get this request to you by Christmas so that if you see Dr. Clements at the Scientific Meeting you can talk the matter over with him.

With best regards, I am,

Sincerely yours,

Dean, College of Letters, Arts
and Sciences.

AED/S.

March 4, 1918.

Dr. F. E. Clements,
Tucson, Arizona.

Dear Dr. Clements:

I am addressing to you the questions which I formulated soon after January 1st, ⁽¹⁹¹⁸⁾ in order to provide a definite outline for the microscopic work by Mr. Loftfield.

First, in the Sequoia Gigantea Group there is a ring suspected immediately following 1580. In most of the fifteen samples the extra ring doesn't show. In one it is apparently a double occurring in the same year with 1580, but in Nos. 16 and 22 it appears very much like an additional year. Can you give me the microscopic evidence as to whether this is an additional year or not and your opinion in the matter?

Second, can you give me in the ~~Washingtoniana~~ ^{same species} ~~Sequoia~~ a means of telling whether the dark red ring was formed in spring and mid-summer, due to lack of moisture, or whether it was formed in the autumn at the time of increasing cold?

Third, can you answer an identical question ~~with~~ ~~the~~ ~~same~~ ~~species~~, with regard to Pinus ponderosa of Arizona?

Fourth, in the piñon and cedar growing in the altitude of Arizona just below the yellow pine, is there any way of identifying correctly the yearly rings which show intense variation both in total width and in width of the red part, and which also from time to time merge together in a puzzling way?

Fifth, is there any way of identifying the rings in the Taxodium distichum?

Sixth, I have ten sections ^{of Pinus ponderosa} from a point about one mile southeast of the city of Prescott, Arizona. I worked over very carefully the rainfall of that city from 1867 to 1912. These ten sections form the basis of the curve in which a relationship is found between rainfall and tree growth at that point, and published in the Carnegie publication No. 192, and in the bulletin of the American Geographical

Dr. F. E. C. - 2.

Society, May, 1914. I am having a copy made of the Prescott rainfall month by month during that interval, and will go over the wood samples and mark the corresponding years. I will also accompany them by a list of double rings worth investigating.

My question formulates as follows: From microscopic examination of the rings of this group of ten from Prescott, can you find for those trees evidence which will tell the time of year in which the cells were formed or conditions of rainfall or temperature under which they were formed?

Seventh, in the Carnegie publication No. 192, "The Climatic Factor", page 111-112, you will find statements in regard to the time of year of ring formation. From that date the conclusion was reached among others that a double ring indicates less rain than a single large ring of the same size. Is this correct and is there anything further apparent from a comparison of those rings and the corresponding distribution of rainfall?

Yours very truly,

Dean, College of Letters, Arts
and Sciences.

AED/S.

March 11, 1918.

Dr. F. E. Clements,
Tucson, Arizona.

Dear Dr. Clements:

microtome

Regarding the remaining problem which Mr. Loftfield might work on, would say that I have been over carefully the ten tree records from the immediate vicinity of Prescott, which I have numbered 61 to 70 inclusive, collected in 1912. I have checked over the identity and cross identification of these ten samples and have marked on each one, near the original line of measurement, the identification in years. In most of them I have smoothed another line crossing the rings, from which ~~this~~ sections may more easily be obtained, and this line also I have placed identification marks on.

The marks which I have used consist of three pin pricks, often emphasized by lead pencil, for the century mark, 1900, two pin pricks for the half-century 1850, and one prick for the even ten years 1860 to 1870, etc. Where the ring is missing it is my custom to place two pin pricks as near together as possible, one on each side of where the missing ring should be. In case of double ring which may cause confusion by seeming to count more than ten years in the decade, I have often drawn a small scratch with the point of a pin across the extra line, which I have concluded is not the actual winter red ring.

These ten samples came from about one mile from the city of Prescott and give the best opportunity which I have yet obtained for close comparison between tree growth and immediate climatic conditions over a considerable number of years. The records in Prescott begin in 1867. I find this little group of ten contains two, numbers 64 and 70 that have the double or triple habit. I want to compare this double with the exact distribution of rainfall during the years from 1867 to 1909. I, therefore, would ask to have:

1. Micro-photograph of section 64 covering this whole period and enlarged so that each year would be $\frac{1}{4}$ of an inch or thereabouts.
2. I would like to have a close microscopic examination of this section through this same period of years with a curve representing it drawn on a large scale

Dr. F. E. Clements - 2.

such as X20 or X30 for the abscissae, and in the ordinates giving the degree of redness and winter characteristics and any notes that may help in the explanation.

Most of the rings are perfectly easy in distinguishing between summer red rings and autumn red rings. There is in this group a good opportunity of finding out whether there is any microscopic difference between the hard red rings formed in late spring or summer due to lack of moisture and the similar wood tissue formed in the autumn when the temperature is low.

In the work on these sections it will be well to corroborate any characteristics in section No. 64 by comparison with the other sections in this group, and this may give an opportunity for going over the whole matter of cross identification and obtaining an independent opinion upon its value. May I say that in even a group as small as this and covering as short a time as this the investigator will feel little else than bewilderment amid these 600 rings until he has memorized some characteristic in every decade. When I first worked on this particular set I had just completed a most painstaking and long continued study of over 3000 rings in 57 different trees from the vicinity of Prescott, so that as I recall it the identification of the rings of these ten sections was a comparatively easy matter.

Faithfully yours,

Director of Steward Observatory.

AED/S.

HARVARD COLLEGE OBSERVATORY
CAMBRIDGE, MASS.

EDWARD C. PICKERING
DIRECTOR

April 23, 1918.

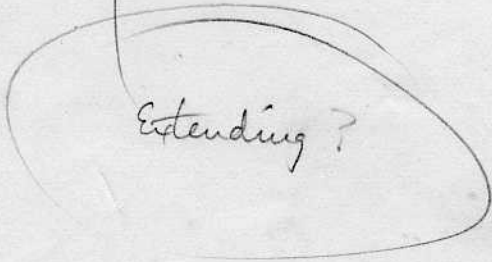
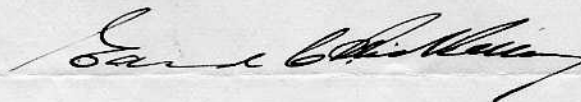
Professor A. E. Douglass,
The University of Arizona,
Tucson, Arizona.

Dear Professor Douglass:-

It gives me pleasure to inform you that an appropriation of \$250. has been made to you from the funds of the American Association for the length of record of tree growth of the Sequoias from about 2200 to 3000 years.

Please send me by January 1, 1919, a statement of the results obtained with it up to that time.

Yours very truly,



Extending?

April 25, 1918.

Dr. F. E. Clements,
Tucson, Arizona.

Dear Dr. Clements:

I have two items, as follows:

First, Will a forest fire cause trees to put on an extra winter-like ring in midsummer?

Successive Second, I have looked over the book on *Plants*, with greatest interest during this past week, and find the whole subject one of great value, and I understand better the relationship of tree rings to it. I am very anxious to get from the Elizabeth Thompson Science Fund, through Prof. Cross, an appropriation to extend the tree record in the Sequoia back to a full 3000 years. As you may know I have asked for an appropriation of \$250.00. The purpose of this was "in order to extend the length of the record of tree growth of the Sequoias from about 2200 to about 3000 years, and at the same time to examine a possible error in the neighborhood of the year 1580. This investigation would mean a careful personal selection of samples in the Sequoia grove, with expenses of transportation, sawing, freight, etc., followed later by the minute comparison of the samples one with another and with the previous ones, and carefully measuring and tabulating the results." (Quotation from letter to Prof. Charles R. Cross, January 7, 1918.)

Did you write to Prof. Cross about this, and if not would it be an advantage for you to do so, express approval to him.

My best time to do this would be in connection with a trip to see the eclipse on June 8th.

Sincerely yours,

AED/S.

Director, Steward Observatory.

April 30, 1918.

Prof. Edward C. Pickering,
Harvard College Observatory,
Cambridge, Massachusetts.

Dear Prof. Pickering:

I have your letter of April 23rd, informing me of the appropriation of \$250.00 from the funds of the American Association for extending the length of record of tree growth of the Sequoia from about 2200 to 3000 years.

I beg to thank you and the Committee very sincerely for this fund towards an object upon which I expect to work this summer with results coming in the autumn.

I will send you a statement of results by January 1, 1919, as you request.

With many thanks, I am,

Sincerely yours,

Director, Steward Observatory.

AED/S.

April 30, 1918.

Dr. Malcolm Douglass,
1814 Tioga Street,
Philadelphia, Pa.

My dear Mac:

I have received notice of an appropriation for extending my records of tree rings from the big Sequoias in California. In order to do this I shall have to make a trip up into the mountains probably about the 15th of June. We will go, I judge, to the mountains about seventy miles east of Fresno in the vicinity of King's River Canyon, and what I shall have to do will be to hunt up stumps that show in the neighborhood of 3000 rings; mark them in some way and later on have samples of wood cut from them. It may take a week's camping up in the mountains.

Can you come out and join me in this trip? I have been intending to write you for a long time, but somehow so many regular duties come on as the days pass on that anything a little out of the regular order gets postponed.

I inclose a solution of a puzzle which you will remember. This solution is not the same as the "half-dozen" which I have on record here.

Remember, too, that the eclipse is on the 8th of June. If you are able to put in some time in Arizona, we, perhaps, could do it at the end of June most conveniently.

Will probably go to Baker City, Washington
Yours,

AED/S.

Director, Steward Observatory.

May 15, 1918.

Mr. M. H. Douglass,
49 Bowdoin Street,
Newton Highlands, Mass.

My dear Brother:

I have made a very careful examination of the prints and negatives of those tree ring photographs and believe that the photographer made a mistake in the kind of plate he used and probably in the color screen. As they stand at present I do not think that any one of them will make a satisfactory half-tone illustration.

The problem which the photographer had was to bring out strongly red lines on white by turning the red lines black. That is done by using a black that is not orthochromatic. An ordinary C23 or C26 would do very well and a color screen should either be none at all or preferably a blue color screen. The development should be for contrast between the surface and the rings. That means he has over-developed most of the plates.

He has also missed the proper illumination. I see that his illumination was something like a window right back of the camera and a little above. It is possible that the illumination would have to be selected for each wood specimen separately. In the No. 10, which you sent on the illumination should be strongly from the right as you face the wood section. The reason that an illumination makes so much difference is that when the wood is surfaced by a plane there is a push^{over} to one side of the little soft tops of the wood cells, and if you get the illumination from the wrong direction with reference to this one-sided surface there is a kind of reflection formed on the cell tops, that drowns out the contrast between the rings and the surface.

I am inclosing a check for your bill and if you have the wood samples, I would ask him to try again. A photographer experienced in producing pictures for publication, especially for scientific publication, would perhaps have run against these matters before and would have understood the color screen better I think. Perhaps the best way to do will be for me to inclose a letter addressed directly to the photographer which you can hand him.

If he refuses to do them again, I would like

Mr. M. H. D. - 2.

to have him at least show clearly that he understood this use of the color screen and orthochromatic plate. In case you have already shipped the wood sections here and he will try again it will probably be cheaper for me to return the sections to you than for me to have it done out here.

I have been tempting "Mac" to come out and see the eclipse on the 8th of June, and then go with me up into the mountains of California to collect some more samples from the big trees in order to extend the series of rings from about 300 B. C. to 1100 B. C., if I can. It would be mighty jolly if you could come out too, and we three could make the trip together. Very probably we would have to camp for some days at an altitude of about 7000 feet, and go around on foot through the forest hunting for the stumps of very great age. These we would have to mark so that we could find them and then I would hire some sawyers to cut my samples from the tops of the stumps.

Let me know what you think of it. Did I tell you that I have hopes of getting east in August. I am sending a copy of the American Forestry for December, 1917, which has on page 734 a print from a photograph of G-8 in this same Group. The photograph was almost perfect. The print does not do it justice as prints usually are inferior to the photographs.

Yours,

Director, Steward Observatory.

AED/S.

*I appreciate tremendously the trouble you
have taken on these pictures and I know
that even I might have to talk hard to
a photographer who had not had
sufficient experience.*

May 15, 1918.

Mr. A. E. Christiansen.

Dear Sir:

I have received through my brother, Mr. M. H. Douglass, the eight negatives of tree sections and the two prints of each. As I have explained to my brother in a letter I find these prints in very fine focus and flat field, but lacking in contrast, so that I believe there is not one of them which will make a good half-tone illustration.

Send
Strongly
planned
I can see two or three items in which the cause may lie. First, in order to bring out the red lines on the white surface of the wood, it is necessary to use an ordinary plate like # 23 or # 26 which is not orthochromatic, and with this plate use a blue color screen if you have one. That will make the red appear black and it will show better. Second, the illumination which I see you used on these seems to be from behind the camera and somewhat above. You will find that the rings stand out and photograph very much better if you select proper illuminations to one side or the other. In the case of the single section which my brother sent to me, the illumination should be from the right as you stand at the camera facing the tree section. The reason of that is that when the wood is ~~plain~~ the surface of the wood cells is pushed over in one direction, and unless the illumination comes from a certain way there is a reflection from the surface which makes it harder to see the rings. I am not sure that all of the sections should have the illumination from the right. That can be told by trying it. In case it should come from the other side it is only necessary to turn the section the other side up without moving the camera. Third, if the surface of the wood is moistened with kerosene just before making the exposure and then allowed to soak in so that it does not actually look wet, the matter of direction of illumination becomes less important and the rings stand out very much better. Fourth, in developing the negatives, I should try for strong contrast in the rings.

In view of the importance of using these prints for purposes of publication, I am asking if you will not be kind enough to try a new set of plates on these tree sections. I will ask my brother to show you a print of a photograph of one of this same group of sections which I had made four or five years ago.

*without
extra
charge*
A. E. Douglass

May 15, 1918.

Messrs. Hume and Bennett *Lumber Co.*
Sanger,
Fresno County, Cal.

Dear Mr. Hume:

You may remember that in August, 1915, I made a trip to the section where you were cutting big Red Woods and obtained from there some very fine specimens consisting of triangular pieces of wood cut from the tops of stumps. You and your employees were very courteous at that time in giving me assistance towards getting these fine scientific specimens. I have made over 50,000 measures of the rings in them, but I find that these rings in the samples which I obtained only count back about 2200 years. I think further samples could be found which would make the full series about 3000 years long, and I am planning a trip this summer probably in the middle of June to get further samples which will do this, and would be very grateful if I can receive good suggestions from you as to how to go about it.

It seems probably that the best place to visit would be the old Converse mill. I think it is near Indian Basin. It is probably that in that vicinity there are a number of stumps which have nearly or entirely the required number of rings, but it will be necessary to hunt about to find them and then get two or more good sawyers to go out there and cut samples.

I would be greatly obliged to you if you would tell me whether it is better to make the trip by wagon from Sanger or whether I should go to Hume, and from there make up a camp outfit which will enable me and possibly one or two others with me to spend a few days near the Converse mill and hunt out the specimens.

I have not published that former work yet but it is practically completed and I think will be in the hands of the printer sometime next autumn. I am trying to get this additional material in order to give a complete 3000 years of tree rings instead of only 2200 in that publication. I shall feel very grateful to you for any suggestions in this matter by which you can help me out.

Sincerely yours,

Director, Steward Observatory.

May 15, 1918.

Dr. Malcolm Douglass,
1814 Tioga Street,
Philadelphia, Penna.

My dear Brother:

I have your letter of the 7th, which came this morning. I have had in mind lately going up the Californian coast to Oregon to see the eclipse on June 8th, and then returning immediately from there to Fresno, California, to go to the big trees which would bring me to the latter place about the 12th or 14th of June. You ought to see the eclipse if you can manage it in any way, and if you come out at all I would arrange to be in some point where it is visible on the 8th. Denver is not at all a bad point. Pocatello in southeastern Idaho is a little better. I notice that a small town called Hartland on the Santa Fe line in Western Kansas, say eighty miles west of Dodge City, is a good place. To get to Pocatello you could come to Denver where possibly I might meet you, but I am not sure we could travel northwest through Salt Lake City to Pocatello and from there up to southeastern Oregon.

To get to Oregon would add a good deal to your trip and car fare. It would be possible for you to go to Denver for the 8th and then to Fresno. The round trip from Tucson to Fresno would cost, I suppose, \$40.00 or \$50.00. Expenses up in the mountains would be very slight for I could pay the major part of them from my fund, since it is almost certain I shall have to have somebody with me up in the camp, and such help as you could give would greatly reduce the time I might have to spend there.

You really ought to see the eclipse if you can for it would be a wonderful sight. I have just been writing to Moses suggesting that he come out also, but I know only too well that a trip across the continent costs a substantial amount.

Yours,

Director, Steward Observatory.

AED/S.