

Detecting Archaeological Remains

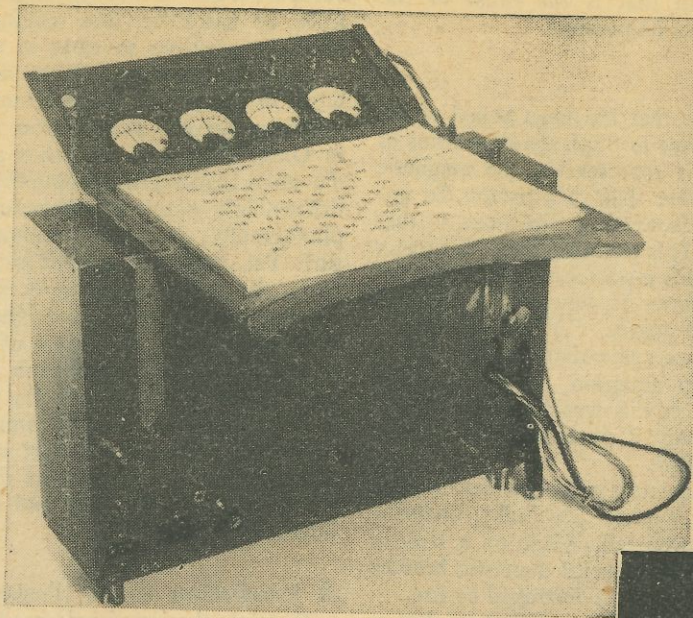
M. J. AITKEN on the proton magnetometer

LAST spring, in the fields bordering the site of the Roman town of Durobrivae, near Peterborough in Northamptonshire, I measured the speed of gyration of the nucleus of the hydrogen atom; that is, a proton. I measured this speed at five-foot intervals over a large area, and in one spot I found that it was a little faster than elsewhere. A test-hole was dug and at a yard down we found the upper rim of a Romano-British pottery kiln.

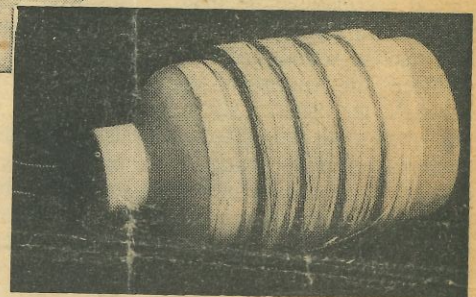
My purpose on the site had been to locate quickly any pottery kilns that lay along the new route of the Great North Road, so that archaeologists would have an opportunity to examine them before the bulldozers moved in. That this might be a good method of archaeological prospecting had been suggested by a Cambridge geophysicist, John Belshé, in 1956, and I was making this first trial of it thanks to the enthusiasm and initiative of the archaeologist conducting the excavations there, Graham Webster.

The link between Roman kilns and protons is magnetism. Protons are sensitive to the proximity of a magnet and a Roman pottery kiln can be regarded as a magnet, strong enough to make an appreciable difference to the behaviour of any protons within ten feet of it.

The instrument used is called a proton magnetometer. It consists of two parts: the sensing element, or 'eye', which is a half-



The two parts of the proton magnetometer: the sensing element or 'eye' (right) is connected by cable to the analysing circuits or 'brain' (above)



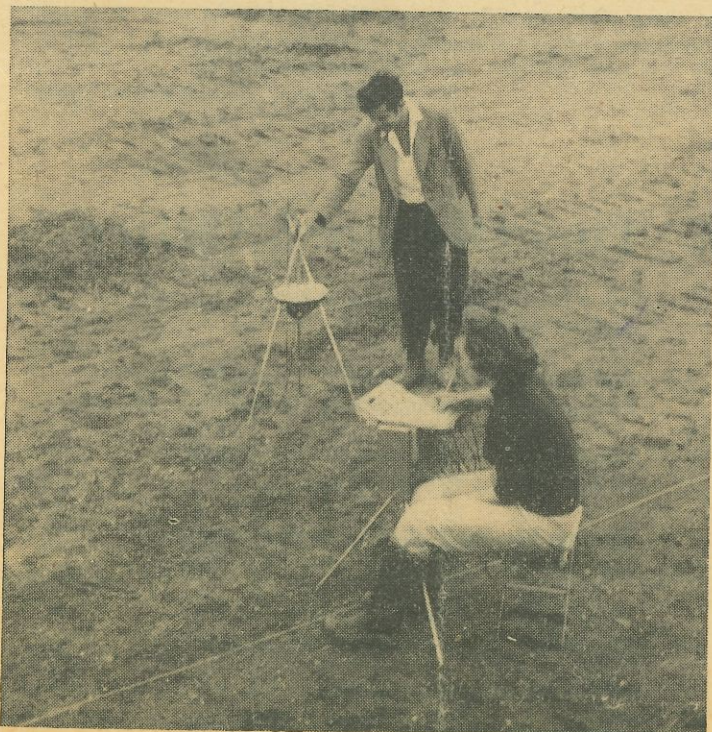
bicycle wheel with the axle horizontal and try to twist it to be vertical, you find that instead of

doing what you want it to, it gyrates around the direction you are aiming at. The harder you try to twist the axle, the faster the gyrations. Exactly the same is true of the protons: the stronger the magnetic force trying to line them up, the faster they gyrate; so, by measuring the speed of gyration, you can deduce the magnetic strength existing wherever you care to place the bottle of water.

The gyrations of the proton do not continue indefinitely; in fact the gyroscopic nature of the proton is able to prevent the magnetic lining up for only three or four seconds. Once the protons are lined up there are no gyrations and nothing to measure. So before each measurement you have to turn a majority of the protons at right angles to their final direction. This is done by applying a magnetic force about a hundred times stronger than the one being measured and in an east-west direction. Such a polarizing force is conveniently obtained by passing a current of an amp through the coil around the bottle. The polarizing force is applied for five seconds and as soon as it is switched off the protons perform their lining-up gyrations. During the few seconds for which these gyrations last one has to make one's measurement.

Because the proton is like a bar magnet, it produces—when it gyrates—an alternating voltage in the coil around the bottle, like a dynamo. The voltage produced is somewhat smaller and even when all the protons gyrate in step only a millionth part of a volt is produced in the coil. This is the same coil that had just been used in the pre-measurement polarizing process and it is now switched to a very sensitive amplifier which increases the size of the voltage nearly a million times. This is then big enough to permit an accurate measurement of its frequency, which is identical with the number of times each proton gyrates per second, and that is what we want to know. Transistors are used in all the circuits, and as a result the instrument is quite portable. It weighs only 23 lb. including accumulators.

Why should archaeological features disturb the normal mag-



A proton magnetometer being used at Dorchester, just south of Oxford, to trace the course of a Roman ditch

netism at the surface of the Earth? It is common knowledge that a lump of iron upsets a compass and so it is readily acceptable that the proton magnetometer should be a sensitive detector of iron nails and horse-shoes. But it is less well known that there is an ore of iron called lodestone which is highly magnetic. This formed the needle of the early mariner's compass. The magnetically active part of the lodestone is appropriately called magnetite, and it is the presence of a small quantity of magnetite in the clay walls of a Roman pottery kiln that is the cause of the magnetic disturbance that makes detection possible.

Baked Clay

To understand why it is only clay that has been baked which gives rise to such a disturbance we have to think again in terms of little bar magnets. This time one is representing the magnetic effect of a particle of iron oxide rather than of a proton. In unbaked clay these particles all point in random directions so that the resultant magnetic effect is zero. It is true that they are subject to a lining-up force due to the Earth's magnetism, but at normal temperatures they are not free to move. If, however, the clay is heated to a dull red heat (about 700 degrees C.) they are able to line-up, and when the clay cools down again they are all fixed in the same direction in this lined-up situation, so the resultant magnetism is appreciable. True, it is still weak, and a kiln six feet down produces a change of only 2 parts in 1,000 in the normal magnetism at the Earth's surface.

Since the proton magnetometer can detect much smaller changes than this, it is also possible to detect other, less bulky, archaeological features where heating has occurred. While on a Bronze Age site in Cyprus last year I detected several domestic hearths and also the remains of a house that had been destroyed by fire.

After the successful location of the first kiln near Peterborough, we covered the remainder of the proposed route of the new road with redoubled enthusiasm. We found five or six magnetic disturbances nearly as strong as the one from the kiln. This created some consternation among the archaeologists because the bulldozers were getting fairly close by now and there would not be time to give to each of these supposed pottery kilns the detailed attention they would merit. All turned out for the best, however, because on excavation these magnetic disturbances were found to come from filled-in Roman rubbish pits. The archaeologists were relieved, because although they contained much interesting archaeological evidence they were comparatively simple to excavate, and I was pleased because the strength of the response to just a filled-in rubbish pit meant that the instrument was capable of covering a far wider range of archaeological features than had been anticipated.

Although there were a few lumps of iron slag in the pits, they were insufficient to cause the magnetic disturbances we detected. The disturbance arises because the magnetic properties of the soil filling the pits are different from those of the adjacent strata in which they had been dug. The particular magnetic property concerned here is the susceptibility of the soil, and this is an effect different from the previous one because no heating process is involved. Although, earlier, I described the little bar magnets of magnetite being fixed in their random directions at normal temperatures, this picture is not exactly true. At normal temperatures some very slight degree of lining-up does take place and if there is a small percentage of iron oxide present in the soil then that soil will be weakly magnetic. The degree to which this occurs is termed the susceptibility. If the susceptibility of the soil is uniform over a wide area and to a given depth then obviously there is no magnetic disturbance.

Susceptible Top-soil

But for various reasons the susceptibility of rock is usually negligible compared to that of top-soil. So if a hole is dug into rock and subsequently filled in with top-soil, then a magnetic disturbance is produced. Similarly, gravel is negligibly magnetic, and last year at Dorchester, just south of Oxford, we were able to detect a Roman ditch just because the bottom of the ditch had cut into the gravel sub-strata and in the course of centuries the ditch had become filled up with top-soil.

The difference in the magnetic susceptibility of top-soil and sub-

strata is a fortunate quirk of nature that makes magnetic prospecting widely applicable in archaeology. An even greater piece of good fortune is that association of top-soil with human occupation enhances the susceptibility still further. The reason for this is not clear but it is presumably due to the action of humic acids in converting the small percentages of iron oxide present to a more highly magnetic form. Whatever the reason, the consequence is that pit-fillings that have been closely associated with human occupation give a much stronger disturbance than those that have filled up naturally, thus making the proton magnetometer particularly sensitive to what is most interesting archaeologically.

Such pits have formed the most striking demonstration of the scope of the proton magnetometer so far. Last summer we made magnetic surveys at two Iron Age hill forts, one near Banbury in Oxfordshire and the other at Bredon Hill near Tewkesbury. To an archaeologist the interior of an Iron Age fort is usually distressingly blank in appearance, even with the aid of aerial photography; it usually amounts to several acres of featureless turf. Yet under this turf lie pits that may contain vital evidence about the people who once occupied the camp. To find these pits by systematic trenching is a laborious and often unrewarding task. I would estimate the chance of finding one by digging a random hole at the camp on Bredon Hill as about one in thirty. But with the proton magnetometer we pin-pointed no less than ninety in the course of five days' work. And not only were we able to indicate to the archaeologist exactly the right place to put his trench but also, without any digging at all, he had a picture of which parts of the camp had been most intensively used by the inhabitants.

A Prediction to be Tested

Recently the instrument has been used on a Roman site between Coventry and Kenilworth, where pottery fragments on the surface had suggested a region about 100 yards across as a likely locality for buried pottery kilns. A day's work with the proton magnetometer located three strong disturbances, but as there were several inches of snow at the time we could not be sure at first that they were not caused by discarded horse-shoes or other lumps of iron lying on the surface. However, by making detailed measurements along a line through the centre of each disturbance and studying the profile so obtained, I deduced that the cause must lie between three and five feet down in each case. This strongly suggests something archaeological, and because the disturbances were so intense and sharply localized the most likely causes are pottery kilns or hoards of iron implements; the amount of broken pottery on the surface strongly favours the former. As soon as weather conditions improve archaeologists will be digging and I shall then see how near the truth are these predictions.

—From a talk in Network Three

The Diamond Cutter

Not what the light will do but how he shapes it
And what particular colours it will bear.

And something of the climber's concentration
Seeing the white peak, setting the right foot there.

Not how the sun was plausible at morning
Nor how it was distributed at noon,

And not how much the single stone could show
But rather how much brilliance it would shun;

Simply a paring down, a cleaving to
One object, as the star-gazer who sees

One single comet polished by its fall
Rather than countless, untouched galaxies.

ELIZABETH JENNINGS

—Third Programme

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/CHJ

9th May 1961.

Miss E. K. Ralph,
Department of Physics,
The College,
University of Pennsylvania,
Philadelphia 4, U.S.A.

Dear Miss Ralph,

Thank you for your letter of 20th April, with news of your thermo-luminescent oven. We are just commencing this, and will let you know progress. We hope to achieve a sufficiently rapid heating by means of 1,000 amps through a graphite plate 2 mm. thick. As you say, warming up of the photomultiplier is a problem, but we are optimistic that with a lucite light guide any heat waves will reach the photomultiplier only after the measurement is complete. Or perhaps bitter experience has taught you different?

As regards Richard Linington, you no doubt appreciate that he came straight to you from a first degree course, and has not been a member of this Laboratory. He did, however, do a small piece of work here one vacation, and we were rather impressed with his ability to force on with it and get it done. I wonder if he is being expected to do too many things at once, as well, I gather, as organising a small laboratory. As far as I know, his electronic experience was gained during two years radar work in the R.A.F.

Many thanks for your Cl4 offprint. I found the full exposition of the statistical analysis very valuable. The application of statistics to results considered as a whole seems highly desirable, and I hope that others will be encouraged to follow.

With best wishes,

Yours sincerely,



M. J. Aitken.

October 27, 1961.

Dr. M. J. Aitken,
Research Laboratory for Archaeology and
The History of Art,
6 Keble Road,
Oxford, England.

Dear Dr. Aitken:

I wish to send you my heartiest congratulations for your fine book entitled "Physics and Archaeology". It is written clearly and concisely, and is an invaluable up-to-date reference both for us in the laboratory and for the students who are studying archaeological techniques. In other words, it is number one on our "best-seller" list.

Our progress here with thermoluminescent dating is still negligible, mostly due to lack of time for it. As usual, I hope to continue this work within the next few months.

I have enclosed a reprint of our most recent publication, and send it with my best regards.

Sincerely yours,

Elizabeth K. Ralph

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RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

EKR:LF
MJA/CHJ

7th November 1961.

Miss E. K. Ralph,,
Department of Physics,
The College,
University of Pennsylvania,
Philadelphia 4,
Pennsylvania, U.S.A.

Dear Miss Ralph,

Very many thanks for your kind words about my book; I am very glad to hear it is appreciated as an awful lot of sweat went into it.

Thank you, too, for sending me the reprint about your Mediterranean Carbon 14 dates. The evidence from Lerna and Pylos for the longer half life is most impressive. I was, however, puzzled by a remark on p. 358 where you refer to making a change to the 5,800 half life, but then infer that you have been using an effective half life in agreement with 5,800 for some time. I expect I have misunderstood you there.

Here at Oxford we are in some turmoil over the dating of the burning of the Palace at Knossos; consequently I was very interested in your dates P341 and P337 for the destruction of the Palace of Nestor at Pylos. The argument over Knossos, as I expect you know, is whether it was destroyed in 1400 B.C. or at the same time as the Palace at Pylos and other places on the mainland. I would value your opinion on any Carbon 14 dating that has been made on the destruction of the Palace at Knossos. On the face of it, it would seem that Carbon 14 dating should be able to distinguish between the two possibilities with a fair degree of certainty. I trouble you with this query because things here do tend to get heavily weighted by the views of the /protagonists.

Miss E. K. Ralph.

7th November 1961.

protagonists.

In our thermoluminescent dating, we have got as far as being convinced that we detect damage in pottery. At the moment we are doing this by feeding the photomultiplier output via a D.C. amplifier to the Y plates of an oscilloscope and photographing the trace. We are still waiting for our X-Y recorder. Our main problem at the moment is that we seem to be producing large amounts of damage by X radiation of an energy that should be unable to create new damage but only to fill existing traps.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'M. J. Aitken', with a horizontal line under the name.

M. J. Aitken.

November 29, 1961

Dr. M.J. Aitken
Research Laboratory for Archaeology and
the History of Art
6 Keble Road
Oxford, England

Dear Dr. Aitken:

Thank you for your recent letter. I can appreciate your puzzlement in regard to our remarks on p. 358 of the reprint. It is a somewhat confusing situation which we probably should have explained more clearly.

When I started making C-14 measurements in 1951 and 1952, I was lazy about calculating and cut down young trees to determine our "zero" age counting rate. I had duplicated Libby's counter exactly, but obtained lower counting rates for modern wood. Libby suggested that my counter was inefficient, but I couldn't believe this, so I measured some archaeologically-dated samples and drew a line through these results as shown in the reprint of our date list I. The net result was more or less the same as the use of an "effective" half-life. This circumvented both the depletion (which has since been interpreted by Suess) and the half-life problems although the latter was inadvertant at the time. After the conference in 1959, however, we conformed with the other laboratories in basing our age calculations on 100-year-old oak (and, indirectly, the oxalic acid standard) and the Libby half-life value.

Our files seem to be incomplete because I have been unable to find any published dates for the Palace at Knossos. If you can guide me as to where to find them, I shall be glad to ascertain what I can in regard to their reliability. I mentioned this dating problem to Dr. Machteld Mellinck (Bryn Mawr College), and she replied that it would be a tremendous help to have Knossos dated more precisely.

Sincerely yours,

Elizabeth K. Ralph

EKR/ic

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P
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April 13, 1962

Dr. M. J. Aitken
Research Laboratory for Archaeology and the History of Art
6 Keble Road
Oxford, England

Dear Dr. Aitken:

Your letter of the 10th of April has arrived. Miss Ralph is now in Italy, working with members of the Lerici Foundation and a group from the University Museum of Philadelphia, testing a number of survey instruments, and is not likely to return until June.

I think you will get a more pertinent reply direct from Miss Ralph, and I am forwarding your letter to her.

Very truly yours,

Robert Stuckenrath, jr.
Research Associate
Carbon-14 Laboratory

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/REB

27th August 1962.

Miss E. Ralph,
The University Museum,
University of Pennsylvania,
33rd & Spruce Streets,
Philadelphia 4.

Dear Beth,

Many thanks for your letters, and I hope your vacation in Ireland was enjoyable. We very much enjoyed having you here, and look forward to your next visit, as soon as you care to make it.

I am glad for your sake that American Express are getting on with the Volkswagon, and shall quite understand, though be disappointed if it has gone by the time I arrive. It was extremely kind of you to have made the offer.

I am enclosing susceptibility results of the material you sent from Sybaris. They correlate well with the Proton Magnetometer measurements, but I still think they are rather on the low side. Was the Matone from test pit D the material on the wall itself? The negligible value for the volcanic rock is very puzzling indeed, and upsets all my expectations.

The Kennedy data arrived in good time, many thanks. I am just off to Rome, and will send you a copy of our thermoluminescent paper in due course. Thank you for sending "Expedition", it is a most impressive publication, and I liked particularly the picture of underwater archaeology.

With best wishes,

Yours ever,

Martin

September 20, 1962

Dr. M. J. Aitken
Research Laboratory for Archaeology & the History of Art
6 Keble Road
Oxford, England

Dear Martin,

Many thanks for your letter and report of soil susceptibilities. The correlations do seem to be reasonable. The matone from test pit D was taken from one of the walls of the Roman structure, about 3 1/2 meters down. That volcanic rock from Tarquinia is very puzzling--perhaps it looks volcanic but isn't.

At the moment, Mark Han is spending most of his time on thermoluminescence and is making a little progress. With the help of a C^{14} activated phosphor which emits about 1 microlambert (blue), we have found that our original arrangement with lens, $CuCl_2$ solution great distances, etc. reduced our light output by 500 times or more (too weak to detect with our galvanometer). Therefore, we have rearranged things as shown:

Dr. M. J. Aitken

Sept. 20, 1962

Page 2

With galvanometer sensitivity at $0.003 \mu\text{a}/\text{mm}$, we get the following deflections:

| | |
|--|---------|
| Light-source in contact ^{with} W.P.M. | = 62 mm |
| Light -source 7 1/2 in. from P.M. | |
| with light-pipe and reflectors in place | 24 mm |
| Same with 1 in. CuCl_2 solution | = 17 mm |

This seems reasonable, and ~~yet~~ I hope that we can heat up some sherds soon to see what our next problem is. This is a good year for borrowing here, so now have light source, x-y recorder, D.C. amplifier, etc.

I have talked briefly to Raza and his wife, and hope to catch them for lunch or a country trip in the near future.

I hope that your Rome trip was fun.

With best regards,

Beth

EKR:dml

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

2nd October, 1962

Miss E. K. Ralph,
Department of Physics,
University of Pennsylvania.

Dear Beth,

Thank you for your two letters, and apologies for not replying sooner. I have gazed at a sample of the sand through a microscope, but cannot see any shells. However, I have now interested a geologist in the problem, and may have some positive information in a few days time. The same geologist is quite interested in Sybaris, and tells me there is quite a useful geological account of the region done by someone in 1913. I will let you have the title in due course.

Thank you for the details of your copper chloride absorption measurements. It ~~does~~ seem to us now, too, that reduction of the black body radiation may be the ~~cause~~^{key} of the problem, and we have on order a number of optical filters, with which we hope to determine the wave length range in which the ratio of thermoluminescence to black body is the highest.

I am enclosing the paper "Thermoluminescent Dating at Oxford", that we presented at the Rome conference. As you see, it is not very encouraging for absolute dating, and we attribute this, in the first place, to annealing of the traps, giving light in the region of our measurements (200 to 400 degrees centigrade); going above this range would seem the most likely hope of the method ever working.

Subsequent to the conference, we visited the Tongiorgi laboratory in Pisa (and saw Skopf again also). It is a most

impressive place, and well worth your attention when you are next in Italy. He has done quite a lot of work on ~~growing~~^{grinding} damage in lime stones, but so far has not touched pottery. He is very pessimistic about any possibility of dating by thermoluminescence. He showed us a very valuable article by Houtermans in a kind of summer school proceeding, held at Varenna in 1960. This increased our knowledge of the subject by a degree of roughly ten! The title of the proceeding is "Summer Course on Nuclear Geology", and it is published by the Laboratorio di Geologia Nucleare. I am not clear whether it is for sale, but we were fortunate enough to be presented with a copy - after some persuasion - and I recommend you to try and obtain one, but if you fail we can try and arrange to have photostat copies made here of the relevant article.

at Pisa

Rome was intolerably hot, too hot even to make the journey down to the Lido. Very much enjoyed meeting Don Brown, and we had many pleasant meals together.

Please give my regards to Raza, and I hope he is settling in.

With my very best wishes,

Yours,

Martin

P.S. The name of the book is "Les Formations Marines" Annales de l'Université de Lyon, by Maurice Gignoux; published in Paris by the Librairie J.-B. Baillière et Fils; but at first sight it does not seem to have any relevance to the Sybaris area, except in pre-historic times. Elsewhere in Italy there is evidence for a marine transgression in the 3rd century A.D. There was no such evidence in the Crati area, although I suppose this does not rule it out absolutely.

The black specks in the sand are highly magnetic (being attracted by a magnet); possibly these might be magnetite, and be a means of tracing the origin of the sand. I will write to Doctor Rainey, enclosing the geologists' comments as soon as they are available.

P.P.S. Very many thanks for your colour prints, which we have displayed in the post-office, and they have attracted much interest and appreciation. Thank you also for the slides; several people are asking for prints.

I am enclosing some copies of the aerial photographs, in case you would like to have them.

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMD

25th October, 1962

Miss E. K. Ralph,
Department of Physics,
University of Pennsylvania.

Dear Beth,

When you were over here you told me about a Detection Symposium at Fort Belvoir organised by Dr. Dvorak. I wrote to him, but the letter has been returned as "unknown". I wonder if you could help any further?

Yours ever,



M. J. Aitken.

October 25, 1962

Dr. M. J. Aitken
Research Laboratory for Archaeology
and The History of Art
6 Keble Road
Oxford, England

Dear Martin:

Many thanks for your letters, reports, aerial photographs, etc. which you have sent to me and to Fro. Please extend our thanks to Dr. Baden-Powell. As you suggested, Fro's days are mostly cluttered up with other things, but we are hoping to have our contract renewed in order to return to Sybaris next spring. Things are naturally vague at the moment and final decisions are subject to Levici's approval, but I am wondering in the meantime if Dr. Baden-Powell would fit in with our Sybaritic life for a week or so next spring and if you think he would be interested in joining us. Levici talked frequently about Italian geologists, but I haven't yet seen one.

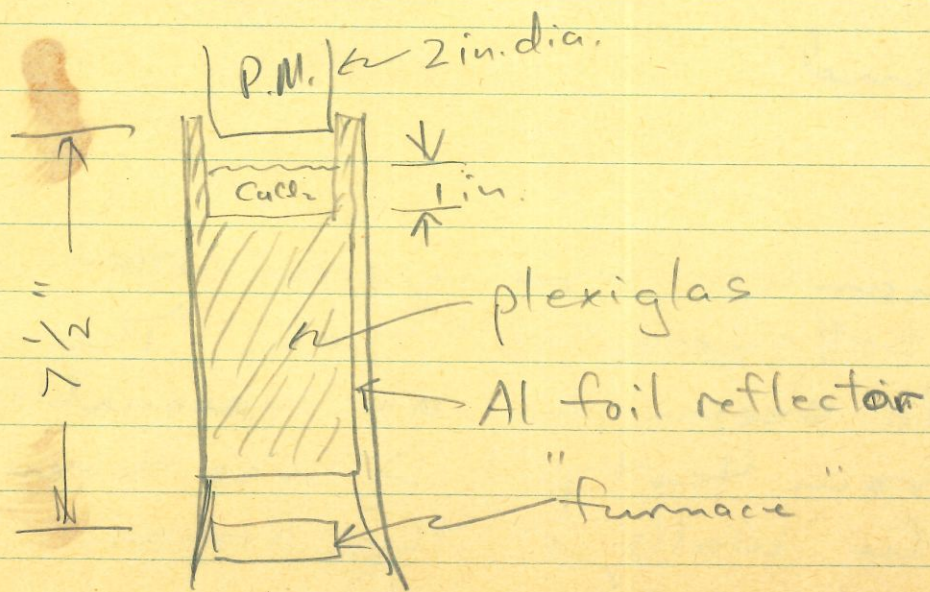
Dr. Baden-Powell's finds are intriguing and I think that he found out a surprising amount with so little to work with. The temptation to make conclusions is tantalizing.

Dr. Pritchard, our new Curator of Biblical matters, has a problem which might be solved by pottery analyses. It is described briefly on the enclosed sheet. Would your Laboratory be interested in tackling this project? If you prefer that I write directly to Dr. Hall about this, gold, and similar matters, please let me know.

With best regards to you and Joan

P. S. Please keep the sand and clay samples. If we happen to get someone here interested in them, I'll write in time for seammil. Judson, at Princeton, is looking at the air samples, but without much enthusiasm.

EKR:pc



6 Noble Road

Oxford, England

Dear Martin,

Many thanks for your letter
& report of soil susceptibilities. The
correlations do seem to be reasonable.

The matone from test pit D was taken
from one of the walls of the Roman

development about 3/4 down

Dr. Pritchard.

Will you please put this in ASCA mailbox when you have finished with it. Thanks, Beth

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMD

2nd November, 1962

Miss E. K. Ralph,
Department of Physics,
University of Pennsylvania.

Dear Beth,

polished/

Thank you for your letter of October 25th. We are quite keen to go ahead with your el-Jib pottery work as it has coincided with another proposal involving pottery in that region. This in fact involves much earlier pottery, and concerns the origin of the red ~~burial~~ ware found in Egyptian tombs of the 1st Dynasty. So if Dr. Pritchard agrees to send us a fragment from each of the jar handles, we will deal with these as soon as the other pottery programme commences. On the assumption that Dr. Pritchard will not wish to send the complete jar handles, I am enclosing a note on the amount of material required and the method of obtaining it.

I am glad Dr. Baden-Powell's report was helpful, and if there is a possibility eventually of knowing when and where Fro's article will appear, both he and I would be most interested to know about it. I am sure Dr. Baden-Powell would be very interested in a visit to Sybaris (though I am not at the moment sure whether he would be able to leave Oxford in term time, but I could find this out), and would apply himself to the geological problems with vigour and persistence. He is, however, a man of getting on for sixty, and while, on the one hand, he might be quite unconscious of the stresses and strains that pervade the work there (if you permit me as an outsider to put it like that), on the other hand he might not respond with understanding to the practical dictates involved. He is a pleasant enough man, except, as it seems with all other professions but physicists', talks too continuously. I will find out his attitude to white wine as soon as possible.

With my very best wishes,

Yours ever,

Martin

M. J. Aitken.

P.S.

Your letter of October 30th has just arrived; many thanks for the abstracts, which I will return shortly. Glad to know you have sent Baden-Powell's report on to Lerici, as I feel the more interest stimulated in geology the better.

November 12, 1962

Dr. M. J. Aitken
Research Laboratory for Archaeology and the History of Art
6 Keble Road
Oxford, England

Dear Martin,

Thank you for your letter of 2nd November. We were very glad to hear that you are interested in Dr. Pritchard's pottery problem. We are breaking off "peas" today and will send the samples pronto. A list of them is enclosed and the pertinent publication about them is following by slower mail.

In a day or two, I hope to send some gold samples to Dr. Hornblower for the real or fake study. These will be selections from the new batch which Mrs. Revere has viewed and photographed with her electron microscope. In these pictures the only thing that I can see that looks vaguely significant is the appearance of what look like lumps in the grooves made by polishing. However, a photograph which she took of a clay sickle looks much the same as the gold.

Dr. Rainey is very grateful to Dr. Baden-Powell for his study of the Sybaris sand and clay, but I suspect that Fro sent his article off just before the report arrived. However, perhaps something can be added in the proof. The article was sent to the Illustrated London News, but he doesn't know yet whether it has been accepted for publication. The article rambles a bit, but I discovered that it makes a fine speech when I stole parts of it to substitute for him at a meeting of an old ladies' club.

The Detection Symposium reports have arrived and one is making its slow way to you by seamail.

Sincerely,

Elizabeth K. Ralph

encl.

EKR:dml

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMD

7th December, 1962

Miss E. K. Ralph,
The University Museum,
University of Pennsylvania,
33rd and Spruce Streets,
Philadelphia 4.

Dear Beth,

I am returning your abstracts herewith. I have recently received the full report, and this is very useful to us. Very many thanks indeed. We are particularly interested in the fluxgate paper, as we are seriously thinking of going ahead and building a differential fluxgate magnetometer.

Our thermo-luminescent work is proceeding, and towards the end of the month I hope we shall be able to send you a note about what we think we have learnt. Progress is not necessarily encouraging. The main work we have been doing is in the reduction of black-body radiation with filters. We have found a cobalt blue filter for instance more effective than copper chloride solution. We will send you details when we have finished.

We have just decided to go ahead with another volume of Archaeometry, and I am wondering whether we can persuade you to contribute? Earlier in the year I suggested some account of the sonic work being done under your auspices, and if there is any possibility of this I would like to have it very much.

Best wishes for Christmas,

Yours ever,

Martin

M. J. Aitken.

info.
Gray has 2 cores - permalloy
Arnold Eng.
Geiger
toroidal
sensing
element
Syben's report
Grant report
Magnaflex Corp.
~~Call for~~
M. Tite
Metallurgy
Consultant -
proposal later

January 7, 1963

Dr. M. J. Aitken
Research Laboratory for Archaeology and the
History of Art
6 Keble Road
Oxford, England

Dear Martin:

Many thanks for your letters, Christmas cards, photograph, reports, and so forth.

SONIC WORK

I shall be glad to try to write something about our sonic work for Archaeometry. If all goes well, in a week or two, I'll take our sonic instrument (the one that didn't work at Sybaris) down to Texas to try some experiments with the Petty Geophysical people, using their impulse and other sources. The main weakness of the thing is its transducer, and I'll find out there also what progress the geophysicists have made on our behalf.

I have enclosed ~~2~~ 1 for two more copies of Archaeometry, vol.4—they're so popular that they disappear.

RESISTIVITY AND SEISMIC SURVEY

Hamilton Carson (a graduate student in Anthropology), who works with us, made an instrument survey last summer with the Geohm and a standard seismic apparatus at the historical site of the U. S. Rife Works, Harpers Ferry, Virginia. This was his first experience with these gadgets, and he chose to make his main test excavation where the resistance readings were lowest, but it happened to reveal a large turbine pit with good walls which evidently retained moisture. In other spots, high resistance readings were found to represent other walls. These things were 5 to 10 ft. deep, and a difference plot of the readings (fortunately he took some readings at both 5 and 10 ft. intervals) has good correspondence with the features revealed by the test excavations. The seismic survey indicated mostly that there was an underlying layer change at 17 ft, but is a good example of why standard seismic surveys are not appropriate for archaeological prospecting. Carson has written a report of the survey and he may have to publish it jointly with the archaeologist who was in charge along with discussions of artifacts, etc. found. If not, however, I'm wondering if we

Dr. M. J. Aitken

could send it to you for you to see if it would be suitable for publication in Archaeometry.

GOLD

I found, to my dismay, that the Registrar had not sent the gold objects in early December and then didn't want to ship them before Christmas. They have been mailed this week, however, by air.

GRANT PROPOSAL

I'm in the midst of writing a new grant proposal (to be submitted to the National Science Foundation) to include some new projects in our ASCA program - primarily a metallurgical branch, but also a pilot dendrochronological study in Egypt, studies of Sumerian technology, and the addition of a physicist to the staff. I'll send you a copy of it as soon as it is in its final form. May I have your permission to list you as a "collaborating scholar from other institutions?". Also, if the grant is awarded (this is somewhat dubious), would Mike Tite be available in September 1963, or do you have another good person who could be persuaded to cross the Atlantic? The answer to this question can wait until April when we know about the grant.

MAGNETOMETER

Our instrument which I left with you has slipped out of my mind for many months. Could you please send me a list of costs for repair and spare parts so that I can send a purchase order? I think we decided upon a complete set of plug-in units, extra cable connectors, etc. Could I bother you too to send here two coaxial cable connectors for use with our gradiometer bottles.

As for Sybaris this year, Fro seems to want to keep the costs down at this moment, and is planning to send only himself, me, and Don Brown as archaeologist. Lerici has offered to provide a geologist. I guess, therefore, that I'll have to go to Rome via England to pick up the magnetometer unless you have a better idea. Of course, it suits me to stop in England, but I hate to think of all of the other gear that I shall be toting too. This will be around April 1st.

George Bass has asked again about using a magnetometer for under-water prospecting, and I've forgotten what you and Dr. Hall have told me. Bass and his divers work from a wooden boat, and would want to go to depths of 100 to 250 ft. where the current is 0 to 3 knots. At a depth of 120 ft., the temperature is 67°F. This is in the Mediterranean, i. e., salty. In the sunken ships and around them they would be looking for masses of pottery, FeO (and Cu, bronze and wood).

Dr. M. J. Aitken

ILN

Fro's Sybaris report was published in the December 8th and 15th issues of the Illustrated London News.

GRADIOMETER

MacLaughlin has revised the circuit, relays, etc. so that it is almost like yours, but it still doesn't work with two bottles. We can get the precession with one bottle. I have it apart in the lab now and each week I plan to tinker with it, but it always seems to be "domanni". Have you found out any new tricks in getting your ten instruments working?

FLUXGATE

MacLaughlin has two small permalloy cores which he would be glad to give to you if you would like to have them.

N. IRELAND

Summer plans for work in N. Ireland are nebulous too. If things proceed as Bernard Wailes hopes, they will excavate the big mound at Navan Fort. Work period will be from June 15th to end of July. If our contract for Sybaris is renewed for 3 months, I may not be able to get there with magnetometer before July 1st. In that eventuality, would you want to do a magnetometer and, if needed, a resistivity survey of the big mound? (Our Museum would, of course, pay your expenses). If my scheming works out, I could join you around July 1st and continue the surveys on the outskirts. Wailes hasn't heard from Dr. Jobe so that we don't know whether or not he is planning to take an active part in the excavations. John Dimick, our Trustee who has provided the funds, may know and he may also have other schemes, but we don't often hear from him either.

I've been wondering if our "moon" drill would be of any use there. We have equipped it with a proper water pump and it now does more or less what Lerici's Jeep drill does in a miniature way (bores are approximately 1 in. in diameter). If things will be shallow there and could be reached with a hand augur or probed with the "spilo", then the expense of shipping the "moon" drill wouldn't be warranted. For the big mound, there is probably no need to drill anyway since it will be excavated, but I am wondering about finding confusing anomalies on the outskirts. Guess I should read something about the site.

Think that I have rambled on long enough.

With best regards,

Beth

EKR/lm
Enc.

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/ES

11th January, 1963.

Miss Elizabeth Ralph,
Department of Physics,
University of Pennsylvania,
Philadelphia 4,
Pennsylvania,
U.S.A.

Dear Beth,

Many thanks for your tremendous letter of January 7th. I will try and make up for the comparative brevity of my reply by promptness!

I am very glad that you will write us something of sonic work and as an encouragement, may I mention that all authors receive Archaeometry free. (We have dispatched by sea mail the two further copies of Archaeometry. Thank you for your £1.) I am interested to read of Carson's work and we would certainly be interested to publish a report by him. Perhaps it would be possible to think of it as a follow-up article from your own more generalised (?) introductory one or if you are able to quote hard and fast test results in yours, then his would be a demonstrative application - though I appreciate that an appreciable part of his will be concerned with resistivity measurements. Perhaps as soon as Carson knows whether he would like it to go in Archaeometry he could send it over so that we have time to discuss it before the going-to-press date of February 28th.

I shall be honoured to be listed in your grant proposal. It is quite possible that Mike Tite will be available by September, 1963, and he should be able to say more definitely in the spring.

I have asked for an invoice regarding the repair work of your magnetometer to be dispatched as well as the two cable connectors. I cannot remember what the situation was about your batteries. There don't seem to be any here belonging

Underwater use of proton magnetometer
from letter of M.J. Aitken
to ER Ralph

- 2 -

to you. Am I right in thinking you ditched them in Rome and that we are to provide new ones? In this case, you will have to decide whether you want them filled and charged (if you are going to collect personally, definitely) or unfilled in case they have to be sent air freight, but a week's notice on this point is amply sufficient.

I very much hope we shall see you in Oxford again at the beginning of April and you would be very welcome to stay with us at Islip again for a day or two if your schedule could allow it.

My own feeling with the under water magnetometer is that the technical difficulties can certainly be overcome and the main question is still whether or not magnetic surveying would be any use in this context. Therefore, the thing would be for someone to try it out as simply as possible in the most optimal conditions. There should be no difficulty in using a 300 ft. cable with a water tight bottle and connector as long as the water is not so turbulent as to put intolerable noise into the cable. In this context we are experimenting with types of special low noise cable and this might very much simplify things. With one cable we have found you can kick it and stamp on it with no apparent effect but, unfortunately, it is magnetic and has rather high resistance. Assuming that a suitable cable is available, the remaining question is the amount of iron carried by the diver himself?

I read the Sybaris report in the I.L.N. with much pleasure and appreciated Fro's kind mention of me. I liked your picture.

The gradiometer can be a real brute but if you have got the precession signal with one bottle, you are well on the way. I can only suggest an intensive attack on it but I do recommend that you arrange a nearby coil fed from a signal generator as a permanent installation for quick checking that the whole circuit is working at any rate from electromagnetic pick up at the correct frequency for your field.

We would certainly be glad to have the two permalloy coils.

I am glad that the Navan excavation is going ahead. We would certainly be keen to do any magnetometer and resistivity (slightly less keen) work necessary before your arrival. It is a difficult time (end of term) for me personally to get away for long but one of the research students should be able to spend at least a week there and I could get over for a couple of days to start things off if necessary.

The main query I would suggest with regard to the "moon" drill is the degree to which this relatively crude method of trial trenching will give interpretable results in the different context of Northern Ireland where the stratigraphy will be much more confused than at Syberis but this is a question for you "moon" drill experts rather than me. Speaking personally, I am all in favour of any method that tears the earth apart quicker than archaeologists' paint brush.

The thermoluminescent front is still confused. We only seem to be learning that it is more and more difficult, particularly the alpha counting.

With all regards for the New Year and I hope you find Syberis this year.

Yours,

Martin

Not so brief after all.

January 21, 1963

Dr. M. S. Aitken
Research Laboratory for Archaeology and the History of Art
6 Keble Road
Oxford, England

Dear Martin,

Many thanks for your letter--much more concise than mine.

For your consideration, we are mailing this week H. Carson's article and also a short one by E. Larrabee about the site. Mr. Larrabee would be very pleased to have his published in Archaeometry as a companion article to Carson's survey report. The main connection with mine is the fact that the seismic survey didn't reveal the historical ruins and, therefore, demonstrates the need to go to shorter wavelengths. I won't know whether or not I'll have any useful test results until I return from Texas which will be on 31 January. Shall send the article as soon thereafter as possible.

About the magnetometer batteries, I did ditch them in Rome. I think it best to leave the new ones unfilled because the solution is one thing that can be obtained in Trebisacce. At the moment, I'm planning to leave here on the Quenn Elizabeth on the 13th of March and will be in England five days later with five days to spend before leaving by train-boat-etc. for Italy. I feel as if I'm stealing two weeks of vacation, but Fro seems to think this plan O.K.

If the Harpers Ferry reports are too long or not appropriate for Archaeometry, please don't hesitate to cut them or to send them back.

With best regards,

Elizabeth K. Ralph

EKR:dml

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/ES

6th February, 1963.

Miss Elizabeth K. Ralph,
Applied Science Center for Archaeology,
The University Museum,
33rd & Spruce Streets,
Philadelphia 4,
Pennsylvania, U.S.A.

Dear Beth,

Thank you for your letter of January 21st. We have looked at Carson's article but reluctantly concluded that only the Seismic part can be justified in Archaeometry. We have written to him to that effect and hope he will not mind our suggested cuts. Alternatively if he decides to seek another journal, then we shall quite understand.

I am glad you will be a few days in England. You will be very welcome to stay with us at Islip for the whole of that five days if it suits your plans. Joan will be delighted to have you and we have a bedroom spare as Niall will still be at school. I shall look forward to seeing you very much too but must say in advance that I am heavily engaged with being an examiner for the week following the 18th. This does not mean 24 hours of the day but it does mean I should have to leave you to your own devices quite a lot of the time. I hope you will come nevertheless.

With best wishes.

Yours ever,

Wentin

February 7, 1963

Dr. M. J. Aitken
Research Laboratory for Archaeology
and the History of Art
6 Keble Road
Oxford, England

Dear Martin:

I have just finished writing about our sonic work, and it is such a tale of trial and error -- of things put together that don't work that I showed it to Dr. Stephens, Professor of Physics, for his opinion. He said quite firmly that a much better article could be written next year (by then we should have an operable something), and advised me to wait. Is this all right with you?

The other choice would be to write a brief thing about the measurements that the Petty Co. has made which have given us some information about how far and at what frequencies a signal that is much too weak will travel. I to to Texas again before Feb. 25th and would have to have their approval for this.

In the meantime, they plan to conduct experiments with more powerful transducers, and then a decision will be made as to whether it is possible to put some workable components together by May. May is the earliest that we can hope to have something which functions to report.

I've enclosed a report of Mark Han's gold analyses.

I hope you will forgive me for not making this decision about the paper sooner.

With best regards,

Elizabeth K. Ralph

EKR:pc

C
O
P
Y

February 11, 1963

Dr. M. J. Aitken
Research Laboratory for Archaeology
and the History of Art
6 Keble Road
Oxford, England

Dear Martin:

In my last letter I forgot to thank you for the various reprints which you have sent. We are glad to have them. The report of Greek silver coin analysis is especially interesting. I have some more questions about the bleeper, but they can wait until I see you.

While in Texas, I saw the TI Helium magnetometer in operation. TI is interested in having it tried out on an archaeological site such as Sybaris. Because of its great sensitivity (0.01 gamma), I'm sure that we should need two instruments and preferably with an arrangement to record difference readings. We are now waiting to hear if they are willing to lend us all of this plus one of their engineers to operate it.

We are not worrying about miniaturization this year and plan to have a truck and generator.

Carson doesn't seem to be upset about your reducing his article and is awaiting your letter.

I am looking forward to seeing you and Joan. I have several errands in London so that if any particular day during the week of March 18th suits you best, I'll plan to come to Oxford then.

With best regards,

Elizabeth K. Ralph

EKR:dml

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMD

16th February, 1963

Miss E. K. Ralph,
Department of Physics,
University of Pennsylvania,
Philadelphia 4.

Dear Beth,

Thank you for your letter of February 11th. First of all, we should be very disappointed if you don't stay a night or two with us at Islip, and do hope you will manage to fit this in. As far as my being occupied with examining goes, I am invigilating all day Monday and Tuesday, and the morning of Wednesday, and as far as marking goes, I am busiest Monday and Tuesday evening. I do hope you come despite my examining - it would give you a chance to admire the architecture of Oxford.

The TI helium magnetometer sounds exciting, and I am full of envy, but I am far from convinced that its high sensitivity won't be anything but a damn nuisance. The possible useful application that does cross my mind is in underwater surveying where random variations might be very small, and the high sensitivity usable.

With best wishes,

Yours ever,

Martin

M. J. Aitken.

London Inst

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMD

29th October, 1963.

Miss E. K. Ralph,
Department of Physics,
University of Pennsylvania,
Philadelphia 4,
Pennsylvania, U.S.A.

Dear Beth,

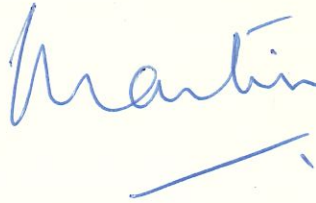
I must apologise for the long silence, but term has rather overwhelmed me. First of all, very many thanks indeed to H. N. Michael for the translation of Burlatskaya's paper. I had seen the curves before in a Russian publication, but had not been able to decipher what they were, nor could I believe that it was seriously suggested that dip had been as low as 30 and as high as 75. I am still accepting this with caution, but it is interesting to note that the Russian results (approximate latitude 40, and longitude 47E, present dip 58°) agree with ours in that they show minimums of dip at 1200 and around 200 to 300. The precision of the minimums is not sufficient to be accepted to better than ± 100 years, and this would just about give time for a disturbance to drift westward from the Caspian to somewhere south of Britain at the present rate of about 0.3° of longitude per year.

No doubt you are more interested in the intensity measurements (and I have still really to get down to the data you sent me some while ago), and I therefore enclose a Russian preface that was inserted in the Russian version of my book. There are a few additional points on the graphs ~~for~~ the Burlatskaya paper. I have been able to obtain only a verbatim translation of the text, but there does not seem to be a great deal new in it as you will see from the summary which I enclose.

Many thanks for the situation regarding Mike; I have passed this on to him. Our thermoluminescence work, though I dare hardly say it, has taken an amazing turn for the better in the last month, now that we have gone over to nitrogen and darkness. Known-age points lie on a straight line to within the estimated errors of measurement - though I should hasten to add that this had to be $\pm 20\%$. Although it will remain to be seen whether it will be a viable dating technique, it looks as though the principle is correct.

With best wishes,

Yours ever,



M. J. Aitken.

Enc.

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMD

30th November, 1963.

Miss E. K. Ralph,
The University Museum,
33rd and Spruce Streets,
Philadelphia 4,
Pennsylvania.

Att'n -
Mr. Reed Knox

Dear Beth,

Many thanks for your letter of November 6th and
the metallograph article of Reed Knox.

We would like to have this in Archaeometry, but I
wonder if Mr. Knox would be agreeable to some recasting
of the article? It is not at all clear to a non-specialist
what exactly he bases his conclusion on, and I think a
clear statement of this in the introductory paragraphs
would be very helpful. One could perhaps have three small
sections: "Introduction", "Technique" and "Conclusions".
I am also enclosing a referee's comment which we would
be glad if Mr. Knox would consider.

We are not keen to see the article any longer than
it is, as we are hoping to reduce the printer's astro-
nomical bill next time.

Many thanks for the copy of the Russian paper, which
is very helpful.

With best wishes,

Yours ever,

Martin

M. J. Aitken.

The properties of steels depend in a very complex manner on the treatment they have been given.

In this article it seems to have been concluded that the presence of cementite, or carbide, nodules in a specimen indicates that such a specimen was originally made of high carbon steel, whilst their absence indicates a wrought iron or very low carbon steel.

There are treatments which can be given to steels, however, which produce extremely fine particles of carbon fairly evenly dispersed in the matrix: for example, a type of martensite can be formed by quenching a steel at temps. slightly above room temperature. The article does not say at what magnification these specimens were examined - if x500 is assumed (from the illustrations) then it is doubtful whether extremely fine particles of carbide in martensite would be observed.

It would seem, therefore, that these experiments can establish positively whether an article was made of steel, but cannot with like certainty state that it was originally wrought iron.

Techniques

October 21, 1964

Dear Martin:

I just have yours of the 19th and am glad to know that you will be here on November 5th. Why don't you plan to come ^{out} to ~~the~~ ^{the} house with me rather than staying at the Sheraton. We can look over the ASCA set up on the 6th. Beth, as you know, is still in Sybaris.

Glad to hear that you have gotten other support for your expenses, but ASCA can still help you out ^{if} necessary.

Looking forward to seeing you,

Very best wishes,

Froelich Rainey
Director

Dr. M. J. Aitken
Research Laboratory for Archaeology
6 Keble Road
Oxford, England

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMR

19th October, 1964.

Dr. F. Rainey,
University Museum,
33rd and Spruce Streets,
Philadelphia 4,
Pennsylvania, U.S.A.

Dear Rainey,

Thursday I shall be arriving in Philadelphia in the late afternoon of 5th November, staying that night at the Sheraton, and I wonder if it would be convenient to visit ASCA during the 6th? I would also like the opportunity to see the Carbon-14 laboratory if that is possible.

I had previously enquired of Beth of the possibility of some support of my expenses from ASCA, but this is no longer necessary as I have received it from elsewhere.

I look forward to meeting you again.

With best wishes,

Yours ever,

Martin Aitken

M. J. Aitken.

January 26, 1965

Dr. M. J. Aitken
Research Laboratory for Archaeology
and the History of Art
6 Keble Road
Oxford, England

Dear Martin:

Many thanks for your letter of January 22nd and your suggestions for revisions of the magnetometric article. I have performed your items 1, 2, 4, 5 and 6 on the second copy. In regard to 3, your original report gave 130 emu/gm as the value. If this is a misprint, please change it.

About item 6, I assumed that Varian had weighed their cable. We are now using the same type with our Elsec, so I made them the same. Ours is slightly heavier than your brown one supplied with the instrument but much stronger. Have now weighed it - 4 lbs. for 100 ft., and have corrected both values, plus Varian's addition in Table 1. Sorry I didn't check these weights before.

With best regards,

E. K. Ralph

EKR:lm

July 23, 1965

Dr. M. J. Aitken
Research Laboratory for Archaeology
and the History of Art
6 Keble Road
Oxford, England

Dear Martin:

Thank you very much for your article entitled, "Thermoluminescence" which was published in Science Journal. Your explanations are very clear and I like the diagrams too.

In the course of writing an article for Science, Sheldon Breiner finally got around to plotting and studying our grids of last fall made at Sybaris. (I had used a copy of Q #15 made in great haste just before we left since he was so slow.) Unfortunately, he discovered that the drill holes on my plot (fig. 3) are 180° out of phase with respect to the magnetic contours. Therefore, I have enclosed a redrawn fig. 3 and changes in the text. Since the proof of the article has already been returned, I imagine that it is too late to make these changes. I hope you'll forgive my carelessness.

We plan to test the new rubidium (or caesium) magnetometer in Arizona starting on August 16th. If all goes well, I plan to return to Italy with it about mid-September.

With best regards,

E. K. Ralph

EKR:ek

Encls.

October 23, 1965

Techniques

Dear Martin:

It has been a long time since I have heard from you and I wonder what is happening. It was good to have Hall here and I think we had some very profitable discussions about our future collaborations, but I think it is important to stay in touch with you at all times. You will be glad to hear that Beth is tickled pink with the new cesium magnetometer, which is working very well indeed and disclosing some very big structures 5 to 6 meters deep in the Parco del Cavallo area. She will continue there until the rains come in November, and then be back here for most of the winter. Also, Mark is very enthusiastic about his thermoluminescence progress, but I imagine he has been in touch with you about this. I still do not have adequate funds for the laboratory and we continue to live "hand to mouth". But at least we stay afloat.

Jeannette Flamm will be probably writing you about notes for our newsletter, which she wants to get out in November.

Pennjoins me in the very best to you and all your family,

Very best wishes,

Froelich Rainey
Director

Dr. Martin J. Aitken
Research Laboratory for Archaeology
6 Keble Road
Oxford, England

FGR/vg

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMR

3rd November, 1965.

Miss E. K. Ralph,
University Museum,
33rd and Spruce Streets,
Philadelphia 4,
Pennsylvania, U.S.A.

Dear Beth,

May I introduce to you Mr. Stuart Fleming, who is currently a research graduate on our thermoluminescent project here and who is going to be on holiday in Boston from 27th November to 7th December.

He would very much like to visit ASCA and particularly to see your thermoluminescent work and meet Mark Han. Recently he has been working on thermoluminescence of the separated mineral fragments, as I mentioned in my last letter.

His address will be 47 Dartmouth Avenue, Needham, nr. Boston, and he will be contacting you from there to see if it is possible to find a convenient day to make a visit.

Many thanks for your letter from Sybaris. I am glad the cesium magnetimeter went well and it certainly sounds a nice toy, but I am afraid I still ask the question as to whether it could really find things that the proton magnetometer can't.

With best wishes,

Yours ever,



M. J. Aitken.

*Mr. Fleming arrived on
December 2, 1965
and spoke with Mark*

February 8, 1966

Dr. M. J. Aitken
Research Laboratory for Archaeology
and the History of Art
6 Keble Road
Oxford, England

Dear Martin:

In an attempt to write a chapter on the application of surveying instruments as part of a guide book for archaeologists, I am trying to include a list of the most suitable instruments and their costs. Shall I include the "Bleeper" or is it superseded by your new Fluxgate Gradiometer? I assume that the "Bleeper" is manufactured by Littlemore, but don't know its cost. Also, can the Fluxgate Gradiometer be purchased from Littlemore and what is its cost?

Mark Han and I went to visit E. J. Zeller last month and he told us about the forthcoming conference on thermoluminescence in Italy in September. The location, especially, appeals to me so that I should like very much to attend. If a short paper would be appropriate, I shall be glad to give one.

With best regards,

Elizabeth K. Ralph

EKR:mhr

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/JMR

18th March, 1966.

Miss E. K. Ralph,
The University Museum,
33rd and Spruce Streets,
Philadelphia 4,
Pennsylvania, U.S.A.

Dear Beth,

I must apologise for having overlooked a reply to your letter of 8th February. If it is not too late:

- 1) Only a dozen Bleepers (or MaxBleeps) were manufactured, by Littlemore, and at a cost of £150. That Company has no immediate intention of making any more.
- 2) The Fluxgate Gradiometer is not available commercially. If it were, a probable price would be around £500.
- 3) I enclose a leaflet about what is effectively a Bleeper made by another firm in England. We had a demonstration of this last week and it looks to be a very useful instrument and certainly a very attractive price (£98). We did comparative tests with it and found that both it and the MaxBleep could detect an anomaly of two or three gammas; with the proton magnetometer we could detect 1/2 gamma. I think it is an ideal instrument to recommend to archaeologists who want to use magnetics on a small scale.

I am glad you will present a paper at Spoleto. Might I suggest that 'Pennsylvania' or 'Philadelphia' should be included in your title in some way. Also, am I right in assuming that you wish it to be a joint paper by yourself and Mark Han? Alternatively, you could each present a short note on different aspects of the work if you so wished.

With best wishes,

Yours ever,



M. J. Aitken.

Dr. Martin J. Aitken
Research Laboratory for Archaeology
and the History of Art
6 Keble Road
Oxford, England

March 30, 1966

Dear Dr. Aitken,

Thank you for your letter of March 18 and pertinent information. Beth has left for Italy and I am trying to track down the address of Martin-Clark Instruments, Ltd. in England. We wanted to mention their resistivity meter in an article but need further information about it.

I have enclosed our letter to them. If you know where they are located we would very much appreciate it if you would forward the letter for us.

Thank you,

Sincerely,

Jeannette M. Flamm

October 17, 1966

Dr. M. J. Aitken
Research Laboratory for Archaeology
and the History of Art
6 Keble Road
Oxford, ENGLAND

Dear Martin:

It was good to see you and Joan at Spoleto. I hope that Neal arrived without mishap -- customs wouldn't let me through the barrier which was very frustrating.

Now that I'm in the midst of writing grant proposals and reports, I realize that I neglected to ask you more about the measurements of remanent magnetic intensity being made in Yugoslavia (?) or some such place. May I trouble you to send me the name and address of the person doing these? Also, if you made some notes of specific measurements and results, if you could include these, it will save me some trouble. The change in magnetic intensity is one of my arguments for continuing our program of comparative C-14 and tree-ring dating -- we need to keep at it until we reach the starting point of the C-14 deviation in order to correlate the two effects.

With best regards,

EKR:LF

E. K. Ralph

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/CAB

20th October, 1966.

Miss E.K. Ralph,
The College,
Department of Physics,
University of Pennsylvania,
Philadelphia, 4,
Pennsylvania, U.S.A.

Dear Beth,

Many thanks for your letter of 17th October.

The man in Prague is Ing. V. Bucha, Boční II,
Prague 4 Spořilov, Czechoslovakia. You will find most
of what he has done in Journal of Geomagnetism and
Geolectricity, Vol. 17, No. 3-4, 1965, pages 407-412.
You will find various other papers that were presented
at the Pittsburg Conference in that volume. I enclose
a photocopy of the page showing his results for the
magnetic field intensity.

Niall got back after a very good journey. We are
extremely grateful to you for delivering him to the air-
port, especially Joan who was viewing the trek down to
Rome with some horror.

If your weather in the south was anything like ours
between Bologna and Milano you would have been very soon
rained off at Sibari. However, I hope it went well
nevertheless.

Joan joins me in sending best wishes.

Yours sincerely,

Riverdèda!

M. J. Aitken

M.J. Aitken

February 8, 1967

Dr. M. J. Aitken
Research Laboratory for Archaeology and the History of Art
6 Keble Road
Oxford, England

Dear Martin,

I suspect that I should thank you for a letter, but I ^{don't} ~~didn't~~ remember where I filed it.

About a year ago, we started an archaeological-metallurgical project (with an NSF grant) with the hope of learning more about the history and technology of metallurgy, etc. Graduate students in archaeology have been studying and selecting various series of objects for metallographic examination. So far, the latter have not been especially elucidating so that we decided to supplement these with chemical analyses, hardness tests, etc. With their compositions known, the metallographic examinations will be more meaningful.

We sent 100 samples of copper and bronze objects from Egypt and Iraq to a commercial company in Philadelphia for X-ray fluorescence analysis. The results weren't good. Except for about 20 of them, they were either too small or too corroded for this technique and the total percentage of elements found ranged from 60 to 90%. The missing 40 to 10% made us doubtful of the whole process. Therefore, we sent 7 of them to the same company for emission spectrographic analysis. Their equipment is only semi-quantitative, but even so there is no agreement between these and the X-ray fluorescence results. For example, for one particularly important object, 3% tin was found by X-ray and none by emission. One of the main things we are trying to learn is when the ancients started to alloy tin with copper.

Would it be possible for Mrs. Millett to analyze these samples with your emission spectrograph? I imagine that 100 samples would take up a lot of laboratory time, but if there is any possibility of this, how long do you think it would take and how many milligrams of each do you need? We have some ~~friends~~ ^{funds} to contribute toward the cost if that would help.

I am wondering if you are planning to attend the IAEA Symposium on Radioactive Dating and Methods of Low-Level Counting in Monaco, March 2-10th. I just found out about it from Hans Suess, too late to get invited. The AEC claims that they advertised it here, but I never saw a notice.

It is about time for a trip, but I gress I'll have to wait until April or May. We are just now getting the results of the infrared and other photography that was taken in June over Sybaris. In one or two bands we are seeing some anomalies. Unfortunately (or perhaps, fortunately), all of them are where we have not been with the cesium magnetometer. This should make an excuse to return.

Mark Han is in the midst of installing a new programmed linear heating apparatus. With this we hope to get more consistent results, especially, if the cut-off point in heating affects the subsequent artificial measurement.

Before this we tested several doubtful Etruscan objects and found that two especially controversial ones had very high radioactivity content - 90 c/hr vs our usual 10-20 c/hr. Therefore, they accumulated measurable light-output in 100 years. We almost goofed with one of them by not measuring its alpha count first.

Hope that all is going well in your laboratory.

With best regards,

Beth Ralph

EKR/gm

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD

MJA/CAB

8th April 1968.

Miss B. K. Ralph,
University Museum,
33rd and Spruce Streets,
Philadelphia,
Pennsylvania 19104,
U.S.A.

Dear Beth,

Thank you for your letter of 3rd April. The second alternative - arriving at the end of May and doing the test surveys at various sites - would in fact suit David and Bob best also. They are also available for the first alternative if required (and this can be at short notice if necessary), but they would find difficulty in joining the trip to Iran.

They are both prepared to pay their fares to Athens but would keenly welcome assistance if available - particularly David as he will be utilizing a travel grant that is strictly meant for thermoluminescence sherd collection; on the other hand, as I presume he will be seeing a number of sites in Greece, it is possible this will not be inappropriate.

Yours sincerely,

With best wishes -
Martin

M. J. Aitken

*I hope we shall see you at Islip
in the course of your travels this summer.*

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD
OX1 3QJ

MJA/WJT

22 August 1969

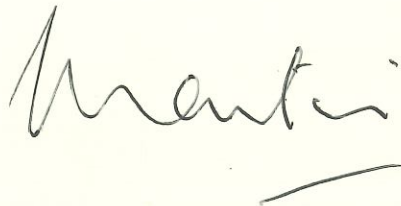
Mrs. B.K. Ralph,
University Museum,
33rd and Spruce Streets,
Philadelphia,
Pennsylvania 19104,
U.S.A.

Dear Beth,

Here is the address of Twentieth Century: Twentieth Century Electronics Ltd., Centronics Works, King Henry's Drive, New Addington, Croydon, Surrey.

I hope you had a quiet time in Belfast and got home safely. I see from the Santorini programme that a hotel reservation has been made for you so I do hope that you will be able to get there after all.

With best wishes,



M. J. Aitken

October 1, 1971

Dr. M.J. Aitken
Research Laboratory for Archaeology
6 Keble Road
Oxford, England

Dear Martin:

Many thanks for your reply to my ~~KL~~ letter and for the recent information about the Kingscote soil. Please extend my thanks to Mike Tite in case I do not write to him right away.

Apparently, it rained here the whole time I was in England, so for once I picked the right place at the right time. It was good too to see you again even though too briefly.

Mark Han is looking forward to the Copenhagen conference.

With best regards,

E.K. Rapph

EKR/um



THE NEW YORK ACADEMY OF SCIENCES

Jan. 20, 1972

Dr. Elizabeth K. Ralph
MASCA
The University Museum
33rd & Spruce Streets
Philadelphia, Pa. 19104

Dear Dr. Ralph:

A note to acknowledge receipt of the photos, et al. Thanks; they should provide suitable illustrations for the article, which I expect will appear in the April issue of The Sciences.

I look forward to receiving the aerial photos, and shall return all materials as soon as we're finished with them.

Sincerely,

Harry Atkins

HA/bs

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 55211

6 KEBLE ROAD
OXFORD
OX1 3QJ

MJA/NH

18th June 1973

Dr. Elizabeth K. Ralph,
Museum Applied Science Centre for Archaeology,
University of Pennsylvania,
33rd & Spruce Streets,
Philadelphia,
Pa 19104,
U.S.A.

Dear Beth,

At long last I am revising my book "Physics and Archaeology". Please can you tell me of any recent publications regarding the Cesium magnetometer?

In connexion with this I find that our library stock of Masca Newsletters is very fragmentary. Is there any chance at all that we can buy a complete set from you?

With best wishes,


M.J. Aitken.

Send
Geoexploration
Bullitt's book
✓ T L articles
All recent
Our book
Sybaris Monograph

Report No. 3
F.O. Haas
October 23, 1974

cc: Dr. Rainey ✓
Dr. Ralph

Dr. M.J. Aitken, Research Laboratory
for Archaeology, 6 Keble Rd., Oxford OX1 3SJ
- October 2 -

The visit with Dr. Aitken was to renew my acquaintance with him and to discuss some common problems.

Replacement for Dr. Carriveau

Dr. Aitken showed me his file of those who had applied for a position in his laboratory but whom he could not take on. The list is attached. I should write to them to get their backgrounds.

The other possibility is to advertise in a journal of Archaeometry. If an advertisement is to be placed in the February issue it needs to be prepared in November.

C14 Regional Meetings

These are held every three years, and Dr. Aitken enquired whether MASCA should encourage the next one to be held in Philadelphia unless Dr. Libby who is retiring wants it in California.

Electron Probe Microanalyser

Dr. Aitken showed me Dr. Hall's electron probe microanalyser. This studies surface changes on aging metals. It is of some value in determining their age. Dr. Aitken gave me some reprints of recent works.

F. Otto Haas

Patrick J.C. Ryall
Geology Department
Dalhousie University
Halifax
Nova Scotia
Canada

William T. Potts (Dr.)
Mineral Sciences
National Museum of Natural History
Smithsonian Institution
Washington, D.C. 20560

Yannis Maniatis
Department of Physics, University of Essex
Wivenhoe Park
Colchester CO4 3SQ
England

P.G. Rowan
Department of Pure and Applied Physics
The Queen's University of Belfast
Belfast BT7 1NN
Ireland

Miss Deborah Parsons
9 Sutherland Road
Armadale
Victoria
Australia

C.G. Cooke
P.O. Box 79031
2145 - Senderwood
Transvaal
South Africa

D.M. Jacobson
Park Village
University of Sussex
Brighton, Sussex
England

S.N. Heavens
Cavendish Laboratory
Madingley Road
Cambridge CB3 0HE

January 13, 1976

Dr. M. J. Aitken
Research Laboratory for Archaeology
6 Keble Road
Oxford OX-1, 3QJ, England

Dear Martin,

Many thanks for the copy of your new edition, and please excuse me for being remiss in writing.

The book is very popular here, so much so that Bob Maddin is planning to use it as the text for a new course that he has initiated. We are ordering three additional copies, but if you have any to spare, they would be welcome.

I am wondering if you attended the conference at Newcastle Upon Tyne. I sent Jeffrey Klein in my place to give a lecture on January 9th. If you happened to hear or meet him, I should appreciate your comments. He is the brightest^{est} most able student that we have ever had in our laboratories. I am trying to promote him, but I have been asked to hire a postdoctoral physicist, and none of the applicants is as capable as Jeff.

With best regards to you & Joan,

EKR/dh

E. K. Ralph

UNIVERSITY of PENNSYLVANIA

PHILADELPHIA 19174

(215) 243-5241

ROBERT MADDIN

University Professor of Metallurgy

5 June 1975

Dr. M. J. Aitken
Research Laboratory for Archaeology
and the History of Art
Oxford University
6 Keble Road
Oxford OX1 3QJ
England

Dear Dr. Aitken,

Professor Maddin is away from the office at this time. However, I talked with him by telephone and he is interested in considering a meeting of the Symposium in Philadelphia in 1977. He will be writing to you more completely some time during the week of the 16th of June when he returns.

Yours sincerely,

Isabelle M. Sullivan

Isabelle M. Sullivan

(Secretary to Prof. Maddin)

cc: Drs. Muhly, Ralph and Wheeler

It looks like a good opportunity; should we take it? I am committed to answer his letter sometime during the week of the 16th of June, hence, would like your input about it.

JUN 5 - 1975

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART
OXFORD UNIVERSITY

TEL. 0865 - 55211

6 KEBLE ROAD
OXFORD
OX1 3QJ

MJA/JEC

29th May 1975

Dr. R. Maddin
University of Pennsylvania
Philadelphia
Pa. 19104
USA

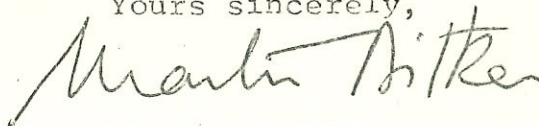
Dear Dr. Maddin,

At the Symposium this year we briefly discussed the possibility of holding it at Philadelphia in some future year. Hugh McKerrell has it organized for Edinburgh for 1976 and all is going well for that (the dates are March 24 to 27). Is it a serious possibility to think of it being in Philadelphia in 1977?

As I have discussed with Hugh it seems to me desirable that the general format should be retained but that the local organizer should feel free to innovate in whatever directions he thinks appropriate. I think the general period of just before Easter is a desirable one to stick to if possible but obviously local conditions may dictate otherwise.

However please do not feel under any obligation to respond to my taking what may have been a very off-the-cuff remark on your part.

Yours sincerely,



M.J. Aitken



April 7, 1976

Dr. M. J. Aitken
Research Laboratory for Archaeology
6 Keble Road
Oxford, England

Dear Martin,

Many thanks for your letter re Jeff Klein.

I have just had an idea. Since Dr. Barbetti is now working with you, would he like to measure some rocks that I collected to look for "recent" pole reversals? These rocks are from side vents of lava flows from Mt. O'Leary in the San Francisco Mountains, about 20 miles north of Flagstaff, Arizona. I have aerial photographs, maps, etc. For the orientation of the rocks, I sighted upon Mt. Humphrey (the highest), but no one told me to mark them in regard to their slope. However, most of them were mostly horizontal.

I took some to Princeton University about 3 years ago, and they had an untrained technician measure them - results, 2 reversed, 2 normal, and 2 indeterminate.

If you or Dr. Barbetti are interested in measuring these, please let me know. I could send them or bring them en route to Nice in September.

With best regards,

EKR:emd

Elizabeth K. Ralph

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART
OXFORD UNIVERSITY

TEL. 0865 - 55211

6 KEBLE ROAD
OXFORD OX1 3QJ

15th August, 1973

Mrs. E.K. Ralph
Department of Physics
The College
University of Pennsylvania
Philadelphia 19104
Pennsylvania
U.S.A.

*Sent preprint
of Newsletter, Vol. 9, No. 1
& Photos of
Figs. 1-6.*

Dear Beth,

Very many thanks indeed for your generous response to my request. I think your nine sample average is at last something the archaeologists can use as a definitive correction, and I certainly hope it will come into general usage. Publishers willing, I would like to show figures 1-6 in toto, possibly with the addition of a 5568 scale. Though am I right in inferring that you regard the 5568 half-life as on its way out? I

I am very pleased to hear the news of your Ph.D. It must be a wonderful relief to have it out of the way, and also a very satisfying thing to have done.

With best wishes,



M.J. Aitken

Joan sends her congratulations on your Ph.D. too. She has just begun (1 year) an Open University degree — 8 years in all!

Please quote : ASC-C252

Strasbourg, 16 November 1976

PRELIMINARY ANNOUNCEMENT

4-7 July 1978 at Oxford

A Specialist Seminar
on
THERMOLUMINESCENCE DATING

The objective will be to give up-to-date coverage of all aspects of Thermoluminescence Dating and Authenticity Testing, with emphasis on relevant radiation dosimetry and inter-laboratory standardization. In addition to lectures by invited speakers there will be contributed papers on current research and application. The orientation will be towards those actively engaged in thermoluminescence and a limitation to fifty participants is envisaged; it is not intended that the meeting should provide introductory lectures.

Those interested in participating are asked to write to
Dr. M. J. Aitken, The Research Laboratory for Archaeology
6 Keble Road, Oxford, OX1 3QJ

To Research Group on Thermoluminescence of the
Study Group PACT (physical and chemical techniques used
in archaeology)

AITKAN

8 Jan 1968

Dear Bett,

Glad to have your card but we are both very sorry to hear you're in hospital. We do hope that all is well now. As regards our crystal we're at present getting the housing made in magnesium. All the aluminium we tried, even Super pure, had a significant alpha count-rate (equivalent to about 0.3 p.p.m. of uranium) and altho' this was well below the level in pottery we thought it sense, in view of the cost of the crystal, to find another metal. Magnesium is lower by $\times \frac{1}{5}$. The crystal is intrinsic Ge, well-type such that we can get about 10 g. of sample in it, and with ~~dia~~ overall diameter equal to height. I will enclose actual dimensions when I post this from the lab. to-morrow. We felt the main considerations were adequate sensitivity for K^{40} on the one hand, and best possible performance from the 46 KeV gamma from Pb^{210} on the other (from the point of view of evaluating the degree of radon retention while sherd was buried).

To what extent we chose the right dimensions
I don't know as we hadn't much
expertise & we had to order in a hurry.
As soon as we have anything at all on
its performance (hopefully early February)
I will send to you in case you can
profit by it.

Are you persuading Bill Stephens
to utilize the Van de Graaff for C-14?
I gather that Roy Middleton's sputter
source is the key to ~~the~~ it & that
Roy's suggestions to various people during
the Symposium last March may have
triggered it off as far as Rochester &
McMaster are concerned. We've now
dropped all our laser plans & ~~to~~ Teddy H.
& Robert Hedges are co-operating with
the Nuclear Physicists (conveniently situated
outside ~~at~~ our back door) in the design
of a small machine which would be
for ¹⁴C ~~only~~ carbon only — but
funds are still the big question mark.
Using the big (EN) machine, ~~the~~ its
been found possible to get good
signal to background for moder

a) carbon with the terminal voltage down at $2\frac{1}{2}$ MV. This uses C^{3+} ~~and~~ and ~~the~~ ~~is~~ 10 MeV ions resulting are detected in a $E \text{ cd } \frac{dE}{dx}$ ^{gas} counter as at Rochester.

Excuse all this mumbo-jumbo if you've not been bitten by the Van de Graaff bug!

I'm only peripheral to our effort but having worked with a synchrotron once upon a time I get rather interested. But when I hear of the bad feeling that's developed between Rochester & McMaster I'm glad to be on the side-lines only.

There's also been bad feeling here between Oxford and ****, in respect of who is going to get Research Council money. We hope it's dying down now so I won't fill in the stars.

We had a quiet Xmas with only fleeting visits by children. I got a lot of wood sawn — and as it was willow it split very easily. Niall went to Bermuda just before Xmas where he has a 6-month appointment as Casualty Officer,

also a Bermudan girlfriend (a charming girl who was over here in England for 3 years). He hopes to visit the U.S. & if he's in your part of it he would to say 'hello' if that's OK? You last saw him when you drove him from Spoleto to Rome airport I think. Jessica has started at University College, London, reading Astronomy, living with some friends on a converted lifeboat on the Thames - I'm envious! Joan has just successfully completed another year at the Open University, one more (her sixth) & she'll be a B.A.! Best wishes from both of us & speedy convalescences

Martin

Dia. } ~ 50 mm . The well is a
Ht. } hole bored right through.

Hole is 20 mm dia in crystal, of which 15 mm is usable.

Before boring, efficiency is 16% & resolution 2.4 keV

Price: £10,500 - £11,000.

Dr. M.J. Aitken,
White Cottage, Islip,
Oxford,
ENGLAND.

2 August 1978.

Dear Martin,

In the process of sorting "get well" cards, I found your letter of 8 January, and want to thank you belatedly for all of the information about the Ge detector, etc.. We sent a grant proposal to the NSF, and have just learned that we shall receive half of the grant. Where we shall find the rest of the funds, I do not know, but that will be Stuart Fleming's worry anyhow.

For years, radiocarbon workers have avoided aluminum because of alpha contamination. I wonder why they used it. Your magnesium sounds fine.

Bill Stephens and Roy Middleton are already experimenting with our tandem Van de Graff. Ion currents are good, but it seems to have a high background for mass 14. Our student, Jeff Klein, is now working on that problem. Roy thinks that it can be done better without his sputter source, but they are still open-minded.

I am now back at work more or less full-time. I do not walk well because of being in bed so long, but am O.K. otherwise.

With best regards to you and Joan,

Elizabeth K. Ralph.

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 0865 - 55211

OXFORD UNIVERSITY

6 KEBLE ROAD
OXFORD
OX1 3QJ

MJA/bc

Dr. Elizabeth K. Ralph,
Museum Applied Science Center for Archaeology,
The University Museum,
University of Pennsylvania,
33rd & Spruce Streets,
Philadelphia, Pennsylvania 19104.
U. S. A.

16th August 1978

Dear Beth,

I was very glad to get your letter of 2nd August and to know that you are in good spirits and getting fitter. This is indeed good news.

Although our Ge detector was ordered more than a year ago it is only expected at the end of this month. They have been having trouble in achieving the expected resolution and from that point of view I gather one is better off with Ge (Li) than with intrinsic. As soon as we have any news at all of its performance I will let you know. Magnesium is all very well but it took us a lot of time to get a casing made without pinholes.

Our carbon-14 plans are going ahead though I am only on the periphery of these. Our Science Research Council has amazed us by giving us a grant to buy a dedicated 2.5 MV machine; this will be housed in Nuclear Physics which is conveniently in our back garden. I am glad to know that Jeff Klein is working on that. It should be good for him and for the project.

Joan joins me in sending our very best wishes and in saying we both were glad to have a chirpy letter from you.

Yours sincerely,



M. J. AITKEN.

UNIVERSITY of PENNSYLVANIA

PHILADELPHIA 19174

The College

DEPARTMENT OF PHYSICS E1

July 16, 1979

Dr. M. J. Aitken
Research Laboratory for Archaeology
6 Keble Road
Oxford OX1 3QJ
England

Dear Martin,

It was with great regret that I read of Dave Zimmerman's death, and since I do not know where Joan Zimmerman is, will you please send her my condolences. I remember the happy days that we had in Greece together.

I am now paying attention to ^{14}C dating. We have slowed down due to lack of anti-coincidence counters. However, within two weeks we should have two sets of multi-anode proportional counters, and also one set of new electronic equipment. Our present equipment consists of vacuum tubes (valves) and is really out-of-date.

I hear that Stuart is rearranging everything in MASCA, but he has not yet obtained any TL dates. However, that is none of my business anymore.

With best regards to you and Joan,

Elizabeth K. Ralph

EKR/bac

RESEARCH LABORATORY FOR ARCHAEOLOGY
AND THE HISTORY OF ART

TEL. 0865 - 55211

OXFORD UNIVERSITY

6 KEBLE ROAD
OXFORD
OX1 3QJ

Ref: 14.7.3

26th July 1979

Dr E. K. Ralph,
Department of Physics E1,
University of Pennsylvania,
Philadelphia 19174,
U.S.A.

Dear Beth,

It was good to hear from you again and to know that your C14 electronic equipment is going ahead.

Yes, Dave Zimmerman's death was very sad and I will mention your sympathy to Joan when I am next in touch. As far as I know she is still at St Louis, but she comes back to England from time to time. Those early days when the subject was newer and the field was smaller were certainly pleasanter than the serious minded way we go about things now.

We are all well here and Joan joins me in sending greetings. She is well established in her part-time hospital job and enjoys it very much.

With best wishes,



M. J. Aitken.

*We do appreciate the continuing arrival
of Expedition.*

University College London, Gower Street, WC1E 6BT 01-387 7050

PROVOST: SIR JAMES LIGHTHILL

PRIVATE AND CONFIDENTIAL

9th November, 1979

Dear Dr. Ralph,

I have been deputed to write to you on behalf of The Royal Society (whose full name is The Royal Society of London for Improving Natural Knowledge) to ask you to be so good as to send me your view about the strength of the case for election of Dr. M. J. Aitken to the Fellowship of The Royal Society. Perhaps I should explain that, in each area of natural knowledge, the Society's aim is to elect to the Fellowship only those persons whose contributions are internationally recognized within their area as a body of work of quite exceptional importance. It is in this context that I am seeking your opinion of Dr. Aitken's own work.

At present, there is no Fellow of The Royal Society whose main scientific contributions have lain in the development and application of new scientific methods in archaeology. That is why the views of eminent experts from outside Britain such as yourself will be of particular importance in helping the Society to evaluate the case of Dr. Aitken. Could I ask you, in particular, if you agree that we have correctly identified in Dr. Aitken that British scientist who has made the most important contributions to the development and application of new scientific methods in archaeology? If so, then I should also appreciate receiving your absolute evaluation of the significance of his work within the global development of his area of science.

With apologies for troubling you, and warmest thanks in anticipation,

Yours sincerely,



Sir James Lighthill,
Provost.

Dr. E. Ralph,
MASCA, University Museum,
University of Pennsylvania,
Philadelphia,
Pennsylvania 19104,
U.S.A.

UNIVERSITY of PENNSYLVANIA

PHILADELPHIA 19104

Faculty of Arts and Sciences

DEPARTMENT OF PHYSICS

November 20, 1979

Sir James Lighthill, Provost
University College London
Gower Street, WCJE6BT
London, ENGLAND

Dear Sir James:

It is a great pleasure for me to recommend Dr. Martin Aitken for membership in The Royal Society. I would say that he is the British scientist who has made the most important contributions to the development and application of new scientific methods in archaeology.

I have known Dr. Aitken for many years, and also several of his students. Both his teaching and research are of the highest caliber. His contributions are definitely recognized internationally as of exceptional importance.

Sincerely yours,

Elizabeth K. Ralph

EKR:bac

June 6 1983

Dr. M.J. Aitken
Research Laboratory for Archaeology
and History of Art
6 Keble Road
Oxford, OX1 3 QJ
England

Dear Dr. Aitken,

It is rather nice to write a letter to you topics other than the Gupta bronze and the TV programme. What I would like from you is the background of what seems to be a disastrous recent history of the new concepts in radiocarbon dating. Vaunted year in and year out, suddenly the publicity surrounding them seems to have died away, notably not just with the Van -der Graaf concept but also the microcounter concept which Harwell seemed so sure could be rapidly implemented. (Incidentally it may interest you that the one approach I felt held greatest promise... direct laser measurement of IR hyper fine separation ... failed to get funding in this past year, in part because of a souring of belief in the Van der Graaf method's progress over here.)

Through my palaeopathology activities I now find myself in the strange situation of having a fine suite of tightly provenanced seed and linen remains from various important Egyptian excavations, plus a group of linens and cottons, from Egypt and Peru respectively, from mummies which urgently need dating. (In each case, the sample size is in the 40mg + range.) I also receive a lot of queries, based upon the previous publicity of the new approaches, from colleagues who also need dates to round off their academic programs, and it disturbs me to have to cool their enthusiasm, by telling them no "micro-dating" service actually exists.

Any more encouraging news you can offer me would be very welcome.

Best Wishes

University College London, Gower Street, WC1E 6BT

PROVOST: SIR JAMES LIGHTHILL

01 - 387 7050

21 December 1979

Dear Professor Ralph

Thank you very much indeed for your extremely helpful comments on Dr Martin Aitken. These are of great value to the Royal Society committee of which I am Chairman. ✓

Yours sincerely



Sir James Lighthill
Provost

Professor E K Ralph
Faculty of Arts and Sciences
University of Pennsylvania
Department of Physics
Philadelphia 19104