PRESERVATION COPY 9/12/2014

December 23, 1959

Miss Elizabeth Ralph
University of Pennsylvania
Physics Department
209 South 33rd Street
Philadelphia 4, Pennsylvania

Dear Miss Ralph:

Mr. I. A. Toivonen of the I. E. Robinson Company, Upper Darby, Pennsylvania, has forwarded your inquiry concerning the Varian Associates Portable Proton Free Precession Magnetometer, the Model M-49. All magnetometers are handled directly from the home office of Varian in Palo Alto. A packet containing descriptive literature, a price sheet, and a lease data sheet are enclosed.

You will note that the M-49 measures the total intensity of the earth's magnetic field in absolute values to a sensitivity of better than ±10 gammas. The proton precession principle allows great convenience in actual field work because there is no instrumetal drift, critical orientation or leveling requirements. A reading may be read directly in field intensity units, gammas, each six seconds.

The M-49 has been used in archeological prospecting, but this field work has not been reported. The only reported references where a proton magnetometer has been used are some work done on the early Roman iron kilns in Briton. We are quite interested in archeological prospecting applications and would be glad to discuss the matter further with more specific detail.

If you have additional questions, or if we may provide an instrument for your use, please feel free to write.

Sincerely,

Lee Langan

Lee Langan, Applications Engineer
Geophysical Instrument Product Group

LL:GT
Enc. M-49 packet

Techniques

July 7, 1964

Dear Mr. Langan:

Following our conversation here at the University Museum, last week, I should like to state that we will be very pleased to have youror one of your associates join our expedition at Sybaris, in South Italy, this fall, with one of your new expedimental rubidium-magnetometers. We would also be pleased to cover travel costs and subsistence at Sybaris, while the experimenting with the instruments is being carried out. Moreover, I shall be glad to cooperate with Varian Associates in the development of electronic instruments for archaeology. The Applied Science Center for Archaeology (A. S. C. A.) here, is established specifically for that purpose, and we shall be most pleased to collaborate with you in any way.

If there is any way you would like to formalize this collaboration in the development of these instruments, please let mekknow. In any case, we look forward to working with you and we trust that our of this will grow practical instruments for archaeology.

Most sincerely yours,

Froelich Rainey
Director

Mr. Lee Langan
Varian Associates
Palo Alto, California

VARIAN associates

611 HANSEN WAY · PALO ALTO, CALIFORNIA · 326-4000

415

July 31, 1964

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

Dear Beth:

Thank you for your letter of July 24 and the interesting analysis that you made of the walls. I have to translate to "PMU's" but hope that in the future the direct reading value of the rubidium magnetometer will allow us to think once again in a unit such as microoersteds (0.1γ). We are making very preliminary plans for the trip to Sybaris and, at this time, Sheldon has been selected to make the trip. If at all possible I will try to come over at a later date, but Sheldon will be the one to gather together all of the equipment and make the trip as far as our plans are concerned now.

He has moved into a new home beginning July 29 and has taken a week's vacation. Shortly after his return he will gather the information he thinks is necessary as far as suggesting bits and pieces that you might plan to bring.

We have not been too successful as yet in our location of a completely portable solid state counter so we are also looking into the possibility of using a digital voltmeter and a portable discriminator which gives us a voltage output. We will keep you posted.

As the dates become more definite, we should try to tie down a two week period around which we might make our plans. I want to thank you again for the pleasant visit I had while in Philadelphia and the lunch at the Faculty Club. I look forward to seeing you again on another visit before or after Sybaris.

Sincerely,

Lee Langan
Manager, Sales
Instrument Special Products

LL:mlb

No Arizona

Sheldon Breiner
ext 2104

Cassano Ionio
30 November 1964

Applied Science Center for Archaeology

THE UNIVERSITY MUSEUM • UNIVERSITY OF PENNSYLVANIA
33rd & SPRUCE STREETS • PHILADELPHIA 4, PENNSYLVANIA
Froelich Rainey, Director EVergreen 6-7400 (Area code 215)
Elizabeth K. Ralph, Associate Director
EVergreen 6-0100 Ext. 8168 (Area code 215)
Cable Address "Antique"

Dear Shelly, [SHELDON LANDAN ?]

Franco & crew have completed the additional drill holes which you designated. I have enclosed a copy of Franco's plan showing the locations of the holes in the grids; and also an abbreviated list of the results which Francesca prepared for us.

I hope to be back in Phila. early next week, and I shall appreciate it if you will have sent me (in Phila.) a copy of your magnetic grid. Martin Aitken asked me to write an article comparing the two types of magnetometers for Archaeometry, and I hope to have it completed before the end of December. Have written a rough draft, but, of course, without the results.

Ridgway has some black & white photos, mostly taken at Taranto, copies of which I'm bringing with me. I'm hoping that my colored ones are OK.

With best regards,
Beth Ralph

Technique

December 18, 1964

Dear Mr. Laagan :

Thank you very much for all the pamphlets, which arrived yesterday. They are very useful. However, it will be even better to have a memorandum specifically related to the work done at Sybaris, and we hope you will be able to prepare it in the near future, though I understand you are very busy.

If there is anything I can do from this end, please let me know. Best wishes for a happy Christmas, and a very good 1965,

Sincerely,

Mrs. John C. Gwinn
Xegretary to Dr. Rainey

Mr. Lee Langan
Manager, Field Engineering
Varian Associates
Palo Alto, California

STRAIGHT TELEGRAM

Techniques

LEE LANGAN
VARIAN ASSOCIATES
PALO ALTO
CALIF.

CONSIDER THIS
CONFIRMATION AND
AGREEMENT TERMS
OUTLINED IN YOURS
OF FEB 12.

RAINEY

Sent VG 2/13
14/65

CLASS OF SERVICE
This is a fast message unless its deferred character is indicated by the proper symbol.

WESTERN UNION
TELEGRAM

W. P. MARSHALL, PRESIDENT

1201 (4-60)

SYMBOLS
DL=Day Letter
NL=Night Letter
LT=International Letter Telegram

The filing time shown in the date line on domestic telegrams is LOCAL TIME at point of origin. Time of receipt is LOCAL TIME at point of destination

PA094 SSB262 P LLH365

(TELTEX 253) PD=PALOALTO CALIF 12 351P EST=

=UNIVERSITY OF PENNSYLVANIA MUSEM, DR FROLICH RAINEY=

APPLIED SCIENCE CENTER FOR ARCHAELOGY (MX) PHILA=

:PLS CFM OUR ORDER TO PROCEED ON DEVELOPMENT OF TWO PORTABLE DIGITAL RUBIDIUM MAGNETOMETERS FOR COMPLETION IN THREE TO FOUR MONTHS. DEVELOPMENT SUPPORT FROM PENN MUSEM AT $15,000 COMMITTED AT THIS TIME. FOR THIS MUSEUM MAY PURCHASE SIMILAR EQUIPMENT OR FIELD SERVICES AT LESS 10 CT OF STANDARD FEES WITHIN A TWO YEAR PERIOD. WE UNDERSTAND IT IS YOUR INTENT TO LEASE THESE FINISHED PROTYPE INSTRUMENTS ON THEIR COMPLETION AS FUNDING

CLASS OF SERVICE
This is a fast message unless its deferred character is indicated by the proper symbol.

WESTERN UNION
TELEGRAM

W. P. MARSHALL, PRESIDENT

1201 (4-60)

SYMBOLS
DL = Day Letter
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The filing time shown in the date line on domestic telegrams is LOCAL TIME at point of origin. Time of receipt is LOCAL TIME at point of destination

(15).

PERMITS. THE FEE WILL BE $5000 FOR EACH OF TWO COMPLETE DEVICES FOR A SIX MONTH PERIOD OF FIELD USE EXTENDING OVER APPROXIMATELY ONE YEAR. IF DESIRED THE MUSEUM MAY APPLY 75 PCT OF LEASES PAID TOWARD PURCHASE OF THIS EQUIPMENT WITHIN LEASE PERIOD ONCE PRICE IS DETERMINED=

VARIN ASSOC LEE LANGAN/3560==

$15,000 10 $50000 75 3560=

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

Techniques

March 25, 1965

Dear Lee:

Just a note to say that I am back from the Near East and I am anxious to know how you are getting on with the digital counter. The A. E. C. is still backing and filling about the grant for this, but they promised me some word by next week. In any case, as you know, I have $15,000 committed to this job, so we are still solvent.

Also, you should know that the Greeks are very anxious for us to try the rubidium magnetometer in the search for Helice, the mother city of Sybaris and I have just been looking at the site which is tough for any magnetometer, but still possible, and I hope to have a crack at it later on this year.

We are certainly expecting to do our preliminary tests at Sybaris in May and June so I do hope things are coming out well.

Very best wishes,

Froelich Rainey
Director

Mr. Lee Langan
Varian Associates
Palo Alto, California

FGR/vg

VARIAN associates

611 HANSEN WAY • PALO ALTO, CALIFORNIA • 326-4000

September 23, 1965

File
Andr
Techniques

Dr. Froelich Rainey
The University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia, Pennsylvania

Dear Fro:

It was indeed very pleasant to spend the evening at your house near Valley Forge on Tuesday, to meet your wife, and to enjoy the pleasant conversation with Dr. Larsen and Dr. Petrovsky. I only regret that my time was so short, and I had to leave before everyone arose. (I hope that I didn't disturb the rest of the house).

Meeting George Bass and his wife was also valuable. He has so much practical experience in the work of finding hidden objects. It is my belief that he has a healthy pessimism as to the advantage of some of the techniques which Hall and I discussed, and this is as it should be. There certainly is no panacea in the variety of technologies which are under consideration. Nevertheless, magnetics has proven valuable, and additional work should be done as it can.

Of course we both still await the outcome of our first cooperative endeavor at Sybaris. As far as the seaborne adaptation is concerned, I believe that Hall and Aitken will procure two sensors and spend some time adapting these to a seaborne magnetometer/gradiometer configuration. They are enthusiastic to do this, they have had some past experience, and they evidence the motivation to do so. Probably all concerned will be somewhat ahead to let them proceed on their own. Certainly they would be willing to cooperate with the University of Pennsylvania with any item they might develop. In the meantime, we also are doing work with U. S. Navy groups on seaborne installations, and some equipment may come out of that.

We will be in touch soon, I am sure. Thank you again for the delightful hospitality and the warmth of your home.

Sincerely,

Lee Langan

LL:GT

ALBERGO MERANDA
9/29/65

Robert Morris
Varian Associates ✓

c/o Oxford
Dr. Hall

wrote again 10/22/65 about grid system, etc.

Dear Bob,

The rain has stopped and we're now having too much warm sunshine. We have been trying various arrangements of the sensors and maybe you can see from the enclosed sketch what we're been doing. With the help of plastic tubes which we found in Conigliano we have tried various arrangements of the sensors (They seem to have to be vertical in order to avoid the wrong mode of operation).

Since we are looking for deep anomalies we found, as expected, that with the sensors 1 meter apart, we couldn't see them as well as with one sensor. With the sensors 3 meters apart, it was better, but since this mode of operation was a bit cumbersome, Giacinto had to rest the staff on the ground for each reading. The field was very uneven & this was reflected in the readings. We seem to get the best results with one sensor (#93) left in a fixed position (see bottom graph). Readings are very uniform, no diurnal changes, & there's only the problem of the long cable leading to the fixed sensor. We tried this out today in the big cow pasture where we worked last year, and

picked up the big anomaly beautifully as well as smaller ones (haven't yet plotted them).

Readout #93 seems to go haywire in the sunshine — must try it in the evening. The most significant number in #90 acted up so that we transferred the unit from #93. Therefore we have one good one in operation — just hope nothing goes wrong.

The signals from the sensors are like this. From #90, it is a bit distorted but it was attached with 30' of cable & #93, with the long one. In the sunshine, the sensors both warm-up within 20 minutes.

With the gradiometer arrangement, each set of batteries lasts for 3 hours. Since that seems to be long enough for Franco & me for carrying them, I haven't tried out my monstrous set of wet cells.

I hope that you are enjoying your trip. Please give my best regards to Dr. Hall.

Tanti cari saluti,

Beth

VARIAN associates

611 HANSEN WAY • PALO ALTO, CALIFORNIA • DAVENPORT 6-4000

October 18, 1965

Miss Elizabeth Ralph, Associate Director
Applied Science Center for Archaeology
The University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia 4, Pennsylvania

Dear Beth:

Sorry to be so tardy in acknowledging the receipt of the grids which you so kindly sent me. I am finally going to get around to making some kind of report on our week in Arizona.

I am wondering if you ever learned whether we had found anything of significance with the instrument. At the time I left, it seemed rather problematical that it was a foundation they were excavating -- or at least Jim, the foreman, seemed to have doubts. If you did learn anything more, I would appreciate your dropping me a note.

Enclosed are some of the photos I took. If you should ever wish additional copies, just let me know.

I much enjoyed our "expedition" and do hope that we will be able to have another trip to the Southwest next summer.

Best wishes,

JM

Jon W. Wilcox, Manager
Public Relations

JWW/dms
Encs.

VARIAN associates

611 HANSEN WAY · PALO ALTO, CALIFORNIA · 326-4000

October 19, 1965

Miss Elizabeth K. Ralph
c/o Mr. Enrico Muellier
Cassana Ionio
Province of Cosenza
Italy

Dear Miss Ralph:

It has been brought to my attention that you are still experiencing some difficulty with two of the display readouts on one of the portable magnetometers. Although it is very nearly impossible to diagnose the cause of this problem, I will make some comments on the subject which may possibly help you.

On one occasion here in the lab, I experienced a similar difficulty and I found that the readout in question was not seated properly in its rear connector. You might try the following remedies:

1. Be sure that the readout is pushed all the way in. The front of the readout should be 1/8 inch in from the outside edge of the front panel.

2. Clean the contacts on the back of the readouts with a soft red eraser.

3. Check the pins on the readout connector, located in the rear of the readout assembly. The pins to which the wires are soldered are quite close together and may be shorting together. Be sure there is sufficient separation between pins. Do not attempt to clean the contacts on the connectors. Such attempts usually result in a damaged connector.

4. Open up the readouts and check the lamps for proper seating as follows:

   a. Release spring clips on rear of readout.
   b. Pull the rear section away from the front section. Separation should occur at one side of the metal block. The lamps are in the rear section.

c. Check the lamps for proper seating by pushing on each lamp with a pencil eraser.
d. Re-assemble by reversing the above procedure but be sure keys are properly aligned.

5. Check for moisture in and around readout plugs. If moisture is present, dry the units in the open air or out in the sun.

I hope one of these remedies may prove successful. In any event, I believe it is safe to assume that the readouts are the problem and you should be able to operate either instrument with the good readouts with confidence.

We are shipping you three meters for the battery charger. Two ammeters and one volt meter. You may find it convenient to have these installed. The wires inside the charger are all marked for meter hookup. Bob Morris should have left with you a diagram showing the intended wiring scheme.

We all wish you great success and hope to hear from you soon.

Cordially,

Bernard D. Smith

BDS:mlb

Bernard D. Smith
Custom Engineering
Quantum Electronics Division

Deane Smith

VARIAN associates

611 HANSEN WAY · PALO ALTO, CALIFORNIA · 326-4000

October 22, 1965

Miss Elizabeth K. Ralph
% Mr. Enrico Mueller
Cassana Ionio
Province of Cosenza
Italy

Dear Beth:

In his last letter, Deane Smith mentioned that he was sending to you the three meters for the battery charger. Actually, we haven't sent them yet because it occurred to me that you may not find having them worth the trouble of getting them; Bob Stuckenrath was unsure that you would want these to come through Lerici, and so am I. Perhaps, too, there are other items that you would like shipped at the same time but of which we haven't yet heard. At any rate, please do let us know how well the work proceeds, and tell me just what I should do with these meters.

My week in southern Italy remains the high water mark of the trip. I am certainly grateful to you for making that period such an interesting and enjoyable one for me personally, and if fervent wishes on my part could make it so your equipment would be working flawlessly (even under inches of water and mud). Do let us know if there is anything more we can do to help from this end.

With best regards to all,

Bob

Robert E. Morris

REM:jp

VARIAN associates
611 HANSEN WAY • PALO ALTO, CALIFORNIA • 326-4000

October 25, 1965

Miss Elizabeth Ralph
c/o Ing. Enrico Mueller
Cassano Ionio
Cosenza, Italy

Dear Beth:

Just as I am writing to ask how things are going, I was handed a statement from the newspaper (enclosed) saying that you mapped out a very long structure and found Sybaris, etc. Whatever you did, congratulations on your good work. I trust, then, that the instruments are working well.

For your immediate interest, I have enclosed a copy of that article from Science in case someone asks you about something. As soon as I receive reprints I will send the Muellers and the Lerici group copies.

It would be of great help to us if we could get some photos of the cesium magnetometer as it is used in the field--pictures of the sensor and especially the readout in the Sybaris area. If you have any such photos that can be mailed back here to be reproduced, we would certainly appreciate it. The only limitation we have is that we would have to have it by November 5.

Good luck in Greece, and let us hear from you even if things are going well. Of course, when we do hear from you it usually means trouble.

Please convey my regards to the Muellers and all of the children. Also say hello to Franco, Jacinto, and the others.

Regards,

Sheldon Breiner
Geophysicist
Quantum Electronics Division

SB:GT
Enc. Science article
V. 150, #3693, p. 185
Article SF Chronicle
10-23-65

VARIAN associates
611 HANSEN WAY • PALO ALTO, CALIFORNIA • 326-4000

November 2, 1965

Miss Elizabeth K. Ralph, Associate Director
Applied Science Center for Archaeology
University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia 4, Pennsylvania

Dear Beth:

Sheldon just sent across a copy of your letter of October 28th in which you enclosed pictures and request return of the enclosed rough contours. I think that picture of me is simply terrific! (@ Baja Mesa)

It will be all over but the shouting when you read this, but we're still glowing from your extremely encouraging progress report, received last week. I'll take care of the other requests you made in your October 28th letter tomorrow when Deane has returned from an other job in the field.

With best regards,

Bob

REM:mlb
cc: S. Breiner

Robert E. Morris
Manager
Custom Engineering
Quantum Electronics Division

December 7, 1965

Mr. Donald A. E. Beer
Hotel de Turistas
Cuzco, PERU

Dear Mr. Beer:

Was glad to hear that the magnetometer worked after a fashion, and that you have had some success.

Your plans for returning the instruments are fine. If you need more time, that is O.K. If not, I'll look forward to seeing you on December 28th.

Sincerely yours,

Elizabeth K. Ralph

EKR/deh

VARIAN associates
611 HANSEN WAY • PALO ALTO, CALIFORNIA • 326-4000

November 9, 1965

Miss Elizabeth K. Ralph
c/o Enrico Mueller
Cassana Ionio
Province of Cosenza
Italy

Dear Beth:

I just received your letter of November 3rd, and Lee also spoke with Dr. Rainey the other day concerning your battery problem. We think that the best thing that can be done from Palo Alto is to ship you five pounds of potassium hydroxide (pellet form) so that you can make up new electrolyte. If the situation continue to demand use of the "portable" batteries at all, Deane and I think that returning the specific gravity of the electrolyte to its proper level will restore the batteries' capability. Of course, this will not solve the problem of the disappearing aluminum. I suggest that in the last extreme you remove the cells from their cases, carrying them about taped together. At any rate, we have shipped this afternoon to Cassana Ionio via air mail special delivery enough KOH to make up approximately two gallons of electrolyte, which should be more than adequate. Using distilled or de-ionized water, make a 30% by weight solution, for a specific gravity of 1.3. Then Deane indicates that the following procedure should be followed to change or add electrolyte to the cells: Charge the battery fully; allow it to stabilize for about 3 hours; remove the old electrolyte; refill with the new solution to 1/8 inch above the plates. (I am certainly glad you have the big lead acid bank.)

We were hoping to send this and possibly some other material over with John Blesch, but it develops he will not be going to Belgium until sometime in January. Accordingly, the meters will not be sent, since I agree that you can probably get along without them for the short time remaining in the field.

Based largely upon your recent experience in the field with these instruments, there is a lot which we wish to do to improve them just as soon as you can return them. Naturally, this includes the batteries and battery cases so I think they should come back with the sensors and the readouts. As you know, we plan to replace all the aluminum in the battery boxes with stainless steel, and Deane is pretty certain he can fix the annoying troubles with the readout and memory. Ship by air from Rome at our expense, if you like.

We are circulating all of your correspondence about the office, since it is so very interesting and encouraging to all those who had a part in developing this instrument. We feel each of your victories and defeats very strongly and are so grateful for your very good letters. The very best of luck in the time remaining, and we look forward to seeing you back here in the States soon.

Cordially,

Bob

REM:mlb
cc: L. Langan
D. Smith

Robert E. Morris
Manager
Custom Engineering
Quantum Electronics Division

P.S. Glad to hear you are getting a change of scenery; now, why not just survey your way back to Rome?

December 17, 1965

Mr. Lee Langan
Varian Associates
611 Hansen Way
Palo Alto, California

Dear Lee:

The TV in Newport, R.I. was a bit of a farce. Couldn't find a thing with the magnetometer because of iron fences, lamp posts, and underground power lines. The instruments have now all been shipped to you.

If Varian is wondering why we haven't paid the $10,000 rental, it is because someone in ASCA filed the bill while I was away. I just happened to find it in a drawer with receipts. The check should now come along within a week.

I have enclosed a few photos. Sorry we don't have better ones.

With best wishes for a Merry Christmas,

Elizabeth K. Ralph

EKR/mhr

January 7, 1966

Dott. Dinu Adamesteanu
Soprintendenza alle Antichita' della Basilicata
Potenza, Italy

Dear Dr. Adamesteanu:

We are now making plans for instrument surveys to be conducted in the spring and summer of 1966. During this next stage of development and experimentation with the new portable cesium magnetometer, the University Museum will act as agent for the manufacturer, Varian Associates. We are planning to offer our services on a contract basis.

The cost of the service is $3000 per month. This fee includes the rental of a cesium magnetometer and its use under the direction of at least one geophysicist.

If you would like us to do a survey at one or more of your sites, please advise us as soon as possible so that we may plan our schedule accordingly.

I hope that there will be time for "la grande cena" this year.

With best regards,

E. K. Ralph
Associate Director

EKR/rs

replied
1/20/66
2 wks. - $1,500 OK

Sant' Agnello (Napoli)
Jan. 14. '66

My dear Beth

I was just going to answer at long last your letter of dec. 11, when your new and more official one arrives. I have spent the last week in Rome (to join the many meetings after the Xmas-New Year holydays) and am, as usual, overwhelmed by work, that should have been finished long ago and is yet far from the end! -

As far as your agreement with Varian Ass. for the use of instruments is concerned, it seems to me very wise and convenient on all grounds (also those to be checked!) - Truly I believe you should act as agents of the Varian since the new magnetometer has been developed and produced by your joint efforts; on the other hand it makes matters easier for others to ask you to go and work on their fields. No fuss, no compliments, but a clear contract arrangement! What is more difficult as a guess is to find out how many field directors or expeditions can afford the cost, particularly in countries, as Italy or Greece, where most of the archaeological research depends from State officials under strict rules and with very scanty funds. I say this because I suppose that you must work out a plan, covering a long period, with many (or at least several) contracts in progress of time during the year.

As far as the Sele field is concerned, personally I can only be grateful for the work you have done with me last year, and must ask you to come back in spring as soon as you are able to do so. Please do not refer to.. idle funds: I wish

I had some active ones! Our "Magna Graecia" budget would sound quite ridicolous to you, as, after all, we raise funds among friends with some contributions from time to time: the Bollingen Foundation (New York) helped us for several years with grants of 2000 to 4000 $ a year; but now they have ceased supporting excavations. However your survey at the Sele must be done: no question and I am sure I shall find the means to cover the cost. I am afraid I have not quite understood if you have definite limits of time (minimum or maximum) for each contract. So I should like to ask you if it might be possible to have a survey only for a fortnight or less, or if your basis is one month.

I hope to read soon your preliminary Sybaris report and am anxious to know more about your future plans in that area. I have not seen Foti nor heard from him since october. I am working on the Sele finds and aiming to publish the "Magna Graecia" vol. next month.

With love and best wishes

Paola

January 20, 1966

Mr. Lee Langan
Varian Associates
611 Hansen Way
Palo Alto, California

Dear Lee:

In response to my inquiries about using our services with your cesium magnetometer, I have received the enclosed reply from Dr. Williams and an informal one from Paola Zancain.

Our joint scheme meets with high approval with Paola and she is hoping to raise enough money ($1500) for two weeks of work at Sele.

I have enclosed some wet cell battery information. Type ER-6-6, although a little short on capacity, would be comparable in weight to the Ag-Cd ones, and much easier to charge. Also, by starting out with 30 volts, we could probably get as much capacity before they dropped below 24 volts.

I am looking forward to seeing you in Maryland on January 31 or thereabouts.

With best regards,

E. K. Ralph

EKR:pc
Enc.

VARIAN associates

611 HANSEN WAY • PALO ALTO, CALIFORNIA • 326-4000

January 21, 1966

Sr. R. Gonzalez R
4ta, Avenida Bella Vista
No. 15 Caracas
Caracas, Venezuela

Dear Senor Gonzalez:

Thank you very much for your letter of January 8 requesting additional information on the magnetometers which we have produced for the University of Pennsylvania. I have enclosed a technical discussion of the use of these magnetometers as outlined in a recent issue of Science magazine. In addition, technical data concerning the instrument is given in an enclosed data sheet (Model V-4938). Photographs of the latest instrument (Model 4930) are enclosed in a preliminary questionnaire discussing it.

This instrument is so new that we have not placed a sales price on it as yet. It is working very well, as the University of Pennsylvania can confirm. At the present time, if your interest is in the field of archaeology, we are attempting to schedule projects through Miss Elizabeth Ralph of the University. If your interest is in geological exploration, we would be glad to hear from you directly and provide you with additional information as soon as it is available. My best estimate now is that reproductions of this equipment will be available in the Fall of 1966. I cannot immediately estimate their price; we are attempting to establish this now. If you desire equipment, please let us know, and we will try to get answers to your questions quickly.

Thank you very much for your interest in Varian Associates, and we certainly appreciated hearing from you.

Sincerely,

Lee Langan, Manager
Geophysical Instruments Sales
Quantum Electronics Division

LL:GT
Enc. Science article
V-4938 data sheet
V-4920 "

bc: Miss E. Ralph

53

FONDAZIONE ING. C. M. LERICI

DEL POLITECNICO DI MILANO

ASCA

CELATA INVENIO

PROSPEZIONI ARCHEOLOGICHE

Roma - Via Veneto, 108 - Tel. 460083

Milano - Piazza Leonardo da Vinci, 32

Tel. 293.889

Roma, January 25, 1966

Via Veneto 108

Dear Lee,

thank you for the magnetic tape, which has now been transcribed. We should have the final report on the symposium ready for the printes within the next few days.

As far as the cesium magnetometer is concerned I was somewhat disappointed that you could not see the way to agreeing to our suggestion; certainly the proposed idea of hiring the equipment at such high rates is quite impossible, as far as we are concerned at the present. Indeed I fear that you will find very few archaeological groups able to meet anything like the proposed charges.

One again thanks for sending the tape. I hope that despite the impossibility of cooperating over the cesium magnetometer we will still be able to keep in contact. Certainly we will always be interested to hear of any new developments.

With all best wishes.

Richard Linington

R.E. Linington

Mr. Lee Langan
c/o Varian Associates
611 Hansen Way/Palo Alto
California/USA

FRO
for your
amusement
Beth

Elizabeth Ralph

VARIAN associates
611 HANSEN WAY • PALO ALTO, CALIFORNIA • DAVENPORT 6-4000

February 26, 1966

Dr. Kenneth M. Rae
University of Alaska
College, Alaska

Dear Dr. Rae:

Recently Dr. William R. Wood visited Mrs. Dorothy Varian in Palo Alto and suggested that you might be interested in information on our company. Specifically he thought you would be interested in using a magnetometer in archaeology. We have enclosed a reprint of an article by Sheldon Breiner describing the application of one of the newer instruments in this field. In addition a data sheet describing the instrument is enclosed to give some insight into its principles of operation; a questionnaire which was prepared is enclosed to show a photograph of the equipment.

At the present time this equipment is still in prototype form. The units that have been produced are being used by the University of Pennsylvania Museum. Dr. Froelich Rainey of the Museum is scheduling units, in cooperation with other Institutes throughout the world, to determine the value of this type of instrumentation under a variety of conditions. You may contact him for any use of the equipment in 1966.

We are pleased to add your name to our mailing list so that you might receive information in the future. If you have any questions, please do not hesitate to contact us.

Sincerely,

Lee Langan, Manager
Geophysical Instrument Sales
Quantum Electronics Division

LL:GT

Enc. Science article
GTM #24
V-4938, 4920 data sheet

bc: Mrs. R. Varian

March 10, 1966

Dr. A. G. MacDonald
Scientific Advisory Branch
Horseferry House
Dean Ryle Street
London S.W. 6, England

Dear Dr. MacDonald:

In confirmation of our telephone conversation, I am writing to say that I shall be working in Italy with the Varian Associates Precision Portable Magnetometer from the end of March to mid-June or July first. My address there is c/o Ing. Enrico Mueller, Cassano Ionio (Cosenza), Italy.

and/or one of the geophysicists from Varian

I should be glad to come to the British Isles when our work there has terminated. Our usual charge is $3000 per month (This includes rental of the instrument, services and expenses of a physicist) or $100 per day plus travel expenses. Since it costs no more to travel from Italy to the U.S.A. via England, travel expenses would not amount to much.

Sincerely yours,

Elizabeth K. Ralph
Associate Director

EKR/rs

October 7, 1966

Mr. Frank Morrison & Mr. Douglas O'Brien
% Mr. Sheldon Breiner
Quantum Electronics Division
Varian Associates
611 Hansen Way
Palo Alto, California

Dear Doug and Frank:

Inoorder to put off writing grant proposals for another day, I have been sorting our grids, etc. and now have them ready for t the following:

Map C - to be blown up to 1:2000
All grids within Map C to be reduced to 1:2000 and also #'s 81, 94, 96, and 98 for comparison
Doria Map - 8½x11 in. photos to be made
Grids located on your big map to be put on our Map A and full-size and ¼ size copies to be made

If any of this will be of any use to you, this copying should be finished within a month (Museum photography always has a waiting list).

I have located the drill holes on Map C and your A', but am uncertain about two grids - Q50 (book pages 1-4) and Q100 (book pages 14, 16, & 17, especially "trivella #4"). If you can send me some information that will help with these, I'll appreciate it.

I accomplished very little in September and when it started to rain and Aiacinto's uncle died (mourning for a week) all on the same day, I decided to pack up.

With best regards,

October 18, 1966

Mr. Shelden Breiner
Quantum Electronics Division
Varian Associates
611 Hansen Way
Palo Alto, California 94304

Dear Shelly:

As a result of the recent article in Science , we have had a number of inquiries about the Cesium magnetometer. I have enclosed a copy of the most interesting one - from Dr. Lyford. Do you mind replying to the inquiry from Dr. Buckmaster on the enclosed card? I can't think of what to tell him.

Since a trip to Havard Forest may be imminent, I haven't sent any of the spare instrument components back to you, but will do so if you need them urgently.

With best regards,

EKR:amg

December 13, 1966

Mr. Sheldon Breiner
QED
Varian Associates
611 Hansen Way
Palo Alto, California

Dear Shelly:

Many, many thanks for your good hospitality and, especially, for the delicious dinner.

I have enclosed some things that Doug and Frank wanted for the completion of their report. Please ask them to return them when they have finished with them. The Q101 drill results are in the book - "Nel Mondo della Natura". I hope that they can complete their report by the end of the year so that we can use it also as a grant report.

Our sensor numbers are:

49-544-90

49-538-63

Best regards to all,

Beth

Encl: As stated
EKR/gm

VARIAN ASSOCIATES

February 17, 1967

Mr. Richard E. Linington
Fondazione Ing. C. M. Lerici
Via Veneto 108
Roma, Italia

Dear Mr. Linington:

Lee Langan has requested me to write you concerning the possibilities of publishing an article in "Prospezioni Archeologiche" about our work last summer with the Cesium magnetometer in the plain of Sybaris. Recently, Beth Ralph of the University of Pennsylvania, Frank Morrison of the University of California, and myself finished a paper on our activities which will be submitted to an American journal, probably Geophysics. The paper is quite a bit more technical than the usual publication in the field of Archaeology. It details a quantitative interpretation of the anomalous total magnetic field due to a long wall discovered in previous surveys. By comparison with theoretical models, we have been able to determine the dimensions and susceptibility contrasts of this wall, and from this to infer the constituent materials and Archaeologic significance of this wall.

Since we have already made prior commitments as to the disposition of this paper, it would be impossible to publish it in your journal. However, it may be possible to publish a brief letter referring to the paper, together with perhaps a drawing or two. I will discuss this matter with Miss Ralph and Dr. Morrison, and will inform you of their decision.

Sincerely,

Douglas O'Brien
Geophysicist
Quantum Electronics Division

cc: Lee Langan
Beth Ralph
Frank Morrison

DO'B:GT

Beth,

If you approve, we could dash off a quick letter to Linington's journal. If not, we'll just let it drop. We'll be sending the original drawings + photo copies next week.

Doug.

varian/611 hansen way/palo alto/california 94303/u.s.a./415/326-4000

Audio unit description + jellied batteries

February 24, 1967

Miss Elizabeth Ralph
Applied Science Center for Archaeology
University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Beth:

Since your last visit here and in a recent telephone call to Lee, you have expressed interest in obtaining one of our reference oscillators for use with your portable magnetometer. We have given the name Audio Indicating Magnetometer (AIM) to this device for it is used by the military for the detection of buried weapons.

This device generates a reference frequency in the range of the cesium Larmor frequencies of normally expected total field values anywhere in the world. The incremental range of the instrument, however, is variable by means of selectable resistors within the oscillator itself, the narrower the range of the oscillator, the higher the resolution. The function of the oscillator is: 1. to produce the reference frequency; 2. to mix this frequency with the Larmor frequency from a cesium sensor; 3. to present the resulting audio frequency on a built-in speaker in the AIM package (or on earphones). The controls include a single knob as an ON-OFF switch and volume control; two lights which indicate the battery voltage 32 volts or higher, 28v -32v, or less than 28v indicating less than one-half useful life in the batteries (The batteries we use are the jellied electrolyte centralab 8-ampere hour capacity batteries which weigh approximately 14 pounds and have the capacity to operate the magnetometer in normal room temperature conditions for approximately 12 hours); and a second knob for the variable reference tone itself. The latter knob is a graduated ten turn 1:1000 potentiometer which can be calibrated in terms of gammas. In theory, you could obtain a "zero-beat" using the calibrated potentiometer dial and thereby know to what field intensity this position on the potentiometer corresponds. It could then be used as a quantitative measure of magnetic field variations as your PPM. The limitation however at present, is that as the reference oscillator gets close to the Larmor frequency, it is suddenly pulled into the Larmor frequency, and you have a dead band, approximately ±10 cycles. This device though is not to be used as a magnetometer at present but only as a detector of anomalies for use in following walls and other anomalies and noting ferromagnetic objects. I have just used the device on some avalanche rescue work in Canada and found it very satisfactory, drifting very little even with large changes in temperature. If you operate with low audio frequency levels say 100 cycles then you can resolve approximately 3 to 5 cycles change and thereby detect a 1 gamma change using the cesium sensor.

The price of this device is $2000 with delivery approximately 90 days. The battery pack which I described for use with this equipment, I believe is superior to the type you are now using. They are contained in an easily carried shoulder and belt harness; they are much more rugged with regard to their charging care, etc.; they are relatively non-magnetic, especially compared to the nickel cadmium; and they are the same power to weight ratio but one-half the cost of nickel cadmium batteries. The price of one belt of batteries at 8 ampere hour capacity at 30 volts is $225 with the present four-week delivery after receipt of an order.

We are just now assembling a letter to grant you deed to the equipment you now have. We should have it out, I hope, in less than 30 days. Let me know how things are going and what you plan on doing this Summer. I like to keep in contact as I am forming an Applications Laboratory here to perform any tasks including those which might be considered support for your efforts.

Regards,

Sheldon

Sheldon Breiner
Geophysicist
Quantum Electronics Division

March 9, 1967

Mr. Sheldon Breiner
Quantum Electronics Division
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Shelly,

Many thanks for your letter. Unfortunately, while waiting to hear about the AIM, we spent most of our remaining grant money, so we cannot purchase one this year. However, I'm sending a purchase order for one set of jellied batteries and belt, and hope that they can be delivered by May 1st.

Our field plans are still a bit indefinite, but chances are that I will be going to Italy in May for a short session at Sibari and Siri. We have a request for work in Michigan in the summer which will probably be for a couple of weeks in late July. The man concerned with the brick structure in Egypt will be here on March 18th, so that I'll find out about that soon.

Many thanks for your kind hospitality and best regards,

Beth Ralph

EKR/gm

varian/611 hansen way/palo alto/california 94303/u.s.a./415/326-4000

March 15, 1967

Miss Elizabeth Ralph
University Museum
University of Pennsylvania
Philadelphia, Pennsylvania

Dear Beth:

On the subject of thermoluminescense, we have had several discussions since your visit. The net result is that I do not feel the time is appropriate for Varian to enter this business; therefore, let us look for some other area in which the University Museum and Varian might again work together.

I report this with some regret and hesitation. It is by no means indicated that we are disinterested in this field completely. At some point, I am sure, we will become involved if we maintain our current interests in nuclear radiation and medical technology. The time is just not right now. We appreciate your taking the time to discuss the technology with the members of our various divisions and regret that the archaeological interests cannot justify our entry now.

Meanwhile, I trust the matters of disposition of the cesium magnetometer, purchase of an Audio Indicating Magnetometer, and the submission of the joint Varian/University of Pennsylvania paper are well in hand.

Please give my regards to Dr. Rainey, and I look forward to seeing you again the next time our paths cross.

Sincerely,

Lee Langan

LL:kr

Techniques

September 8, 1967

Dear Mr. Taylor:

Following our telephone conversation with your office, I wish to clarify the matter of the two sensors which we have been using in Italy.

By accident, we apparently sent back the sensor with the serial No. 63 instead of serial No. 93. Sensor 63 arrived there about August 1st. Sensor 93 is still in use in Italy. Could you clarify your records substituting sensor 63 for 93 which should have been returned on August 1st.

Most sincerely yours,

Froelich Rainey
Director

Mr. William Taylor
Marketing Service
QED
Varian Associates
Palo Alto, California

FGR/vg

varian/611 hansen way/palo alto/california 94303/u.s.a./415/326-4000

September 12, 1967

Rec'd
ASCA

Dr. Froelich Rainey, Director
The University Museum
University of Pennsylvania
Thirty-third and Spruce Street
Philadelphia, Pennsylvania 19104

Dear Dr. Rainey:

Thank you for your letter of 8 September 1967 wherein you clarified the sensor serial number confusion. We will change our records to reflect S/N 63 as fulfilling and terminating the lease. This was on your purchase order 134923 and originally was for S/N 93.

If we may be of further assistance, please so indicate.

Very truly yours,

William M Taylor

William M. Taylor
Manager
Marketing Services
Quantum Electronics Division

WMT:dh

varian/611 hansen way/palo alto/california 94303/u.s.a./415/326-4000

September 29, 1967

Dr. Froelich Rainey, Director
Applied Science Center for Archaeology
The University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Dr. Rainey:

For three years now, the Quantum Electronics Division of Varian Associates and the Applied Science Center for Archaeology have been working together to investigate the application of magnetometers and other devices to archaeological exploration. As you know studies were first conducted under your direction in Canada and later on the Plain of Sybaris in Italy by Elizabeth Ralph with some support from Varian personnel. As a result of those initial studies, we developed and constructed a direct reading Precision Portable Magnetometer with a resolution of 0.1 gamma. This instrument is the most sensitive portable magnetometer equipment in the world today. The PPM as you and Miss Ralph have described in your publications was used to outline additional areas of interest in the Plain of Sybaris in both the 1965 and 1966 field seasons. The opinions of those using it in the field were that the instrument performed very satisfactorily for this and other exploration areas.

The Precision Portable Magnetometer with two cesium sensors Model 49-544, Serial Numbers 90 and 93 and one Digital Display Unit, Model 49-116, Serial Number 93, a portable battery case, and charger are now in the possession of the Applied Science Center for Archaeology. The development of this equipment from existing cesium magnetometer technology was partially supported by the ASCA of the University Museum. It is in our best interests to continue such cooperative programs to develop methods of improved archaeological exploration. The results not only aid the archaeologist and anthropologist but also may have profound effects on geophysical and other exploration techniques. Moreover, we are interested in furthering developments of other means of archaeological exploration in the fields of electromagnetic exploration, methods of age dating, perhaps seismic methods, and any other exploration and research tools using sophisticated instrumentation or unique geophysical methods.

As a means of cementing our relationship and expressing our appreciation for your part in this cooperative development program, we hereby grant to the Applied Science Center for Archaeology of the University Museum of the University of Pennsylvania, title to the instruments described on the attached invoice. Their salable value as new instruments is approximately $17,500. We shall cooperate wherever possible in maintaining the instrumentation but at this time must assume it to be without warranty.

We would be most happy to keep you informed of the latest development in magnetometers and other tools for exploration and look forward to a continued good relationship. Thank you very much.

Very truly yours,

Edward M. Fryer

Edward M. Fryer
General Manager
Quantum Electronics Division

EMF:SB:bj

Attachment

varian
611 hansen way/palo alto/california 94303

REPRESENTATIVE

MAKE ALL REMITTANCE TO NEAREST ADDRESS BELOW

VARIAN P.O. Box 8085, Church St., Station, New York, N. Y. 10008
VARIAN P.O. Box 2342, Chicago, Illinois 60690
VARIAN P.O. Box 3743, Rincon Annex, San Francisco, Calif. 94120

SHIP AND/OR CHARGE TO	CHARGE TO (IF DIFFERENT THAN SHIP TO)	ORDER NO.
Applied Science Center for Archaeology The University Museum University of Pennsylvania 33rd and Spruce Streets Philadelphia, Pennsylvania		50433
		ORDER DATE 9-14-67
		TERMS NET 30 DAYS

CUSTOMER PURCHASE ORDER NO.	GOVERNMENT CONTRACT NO.	PRIORITY	INV	F O B	SHIP VIA
			3	PALO ALTO	Billing Information Only

CUSTOMER CODE	TERRITORY CODE	TPR	CLASS	SHIP BY	INVOICE DATE	INVOICE NO.
162940	0000-0	1	99-393		9-14-67	52516

ITEM	PRODUCT CODE	QUANTITY ORDERED	CATALOG NO. AND DESCRIPTION	SERIAL OR PART NUMBERS	UNIT PRICE	BALANCE ON ORDER	QUANTITY SHIPPED	AMOUNT
			The items described below are given to the Applied Science Center for Arachaeology by Varian Associates, Quantum Electronics Division, 611 Hansen Way, Palo Alto, California. The value of this equipment is $17,500.00					
1		2	Cesium Sensors, Model 49-544 s/n 90 and 93		N/C	0	2	N/C
2		1	Digital Display Unit, Model 49-116 s/n 93		N/C	0	1	N/C
3		1	Portable Battery Case		N/C	0	1	N/C
4		1	Charger		N/C	0	1	N/C

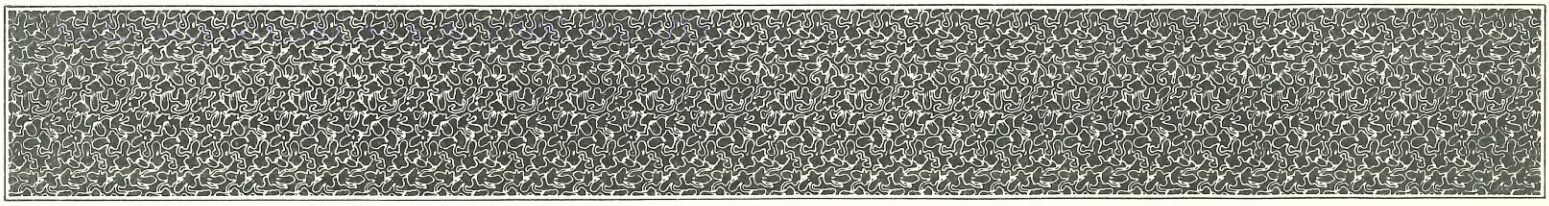
NOTICE: This Varian Magnetometer is not designed for airborne geophysical exploration. It is a patented and proprietary instrument which is sold on the condition that the buyer agrees for himself, his successors and/or assignees, that it will not be used as, or converted to use as, an airborne magnetometer and/or airborne gradiometer without the express written consent of Varian Associates.

SELLER HEREBY CERTIFIES THE ABOVE BILL IS CORRECT AND JUST THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED; AND THAT ALL APPLICABLE STATUTORY REQUIREMENTS INCLUDING THE PROVISIONS OF THE FAIR LABOR STANDARDS ACT OF 1938 AS AMENDED, HAS BEEN COMPLIED WITH. SELLER FURTHER CERTIFIES THAT STATE AND LOCAL TAXES ARE NOT INCLUDED IN THE UNIT PRICE. SELLER ALSO CERTIFIES THAT THE ABOVE PRODUCTS HAVE BEEN MANUFACTURED AND TESTED IN ACCORDANCE WITH ALL APPLICABLE SPECIFICATIONS.

SALES TAX _____

TRANS. _____

INVOICE TOTAL $ N/C



ORIGINAL INVOICE

MASCA file

Archeo-Techniques

October 5, 1967

Dear Mr. Fryer:

First, let me thank you and Varian Associates for your very handsome gift of the cesium sensors and the digital display unit which you have presented to the University Museum of the University of Pennsylvania for our research purposes. I donnot know whether you have yet received a report about the very great success of the cesium magnetometer at Elis,near Olympia in Greece; an experiment which we carried out this summer. There, the Greek Covernment was about to build some big drainage ditch which was scheduled to pass through the site of Elis. Professor Marinatos asked me to send out Miss Ralph with the cesium magnetometer to see if we could pick up the city ruins on the path of the proposed drainage ditch. We found that very extensive building ruins lay one to five meters deep and could easily be detected by the cesium magnetometer, ?Therefore, the whole settlement, which was largely unknown, can be mapped. This successfully preserved the ruins from destruction and we will continue next spring to map the site.

I, too, feel that our collaboration with Varian Associates has been most successful, and I am eager to continue it one way or another. At the moment we are involved in some rathereexciting experiments with the U.S. and Italian Air Forces in infrared aerial photography. Moreover, we have expedimented in the southwest U.S. with infrared scanners and other remote sensors, and I should have detailed study of these photographs from the Hanscom Air Force base in Massachusetts.

We will certainly keep you posted about these developments. You may also be interested to know that Dr. Pecora, Director of the U.S. Geological Survey, has had me sitting with the planning group for the satellite EROS, with the idea that it may actually be possible to do archaeological survey from the satellite with various remote sensors now being developed.

Also, I have been in touch with Dr. Kenneth Crowe, Department of Physics, University of California at Berkeley, regarding the development of a sonic device for archaeological prospectingwwhich he has recently tried out at our Maya site of Tikal, in Guatemala. I have yet no report of that investigation, but have written Dr. Crowe and hope we may get together with you if he has had any success with his device.

Finally, Mark Han, in our laboratory,here, tells me that he has reduced the probable error in the thermoluminescence method for dating pottery, to something like 5% to 7%. This is a very great improvement in the technique during the last year, and I hope before long, many laboratories will be utilizing this equipment.

If at any time I can forward our joint research in this field, by visiting you in Palo Alto, please let me know. This happens to be my principal research interest at the moment and I am getting most enthusiastic about the probable effect of these new techniques on archaeology in general.

Most sincerely yours,

Froelich Rainey
Director

P.S. By the way, if Varian would like to receive an official statement for tax purposes, I will be very pleasedto acknowledge for the University of Pennsylvania a gift for the value of $17,500 from the Varian Associates.

Mr.Edward M. Fryer
General Manager
Quantum Electronics Division
Varian Associates
Palo Alto, California 94303

FGR/vg

varian/611 hansen way/palo alto/california 94303/u.s.a./415/326-4000

November 22, 1967

Miss Elizabeth Ralph
Applied Science Center for Archaeology
University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Miss Ralph:

Sheldon Breiner informed me of your intention to purchase an audio indicating readout for use with your portable digital cesium magnetometer.

The present audio accessory unit, Part No. 49-115B, provides a maximum resolution of approximately 1/10 gamma when a zero beat is maintained between the sensor signal and the reference oscillator. The audio indicating signal affords rapid search techniques to detect and localize the anomalous source. An experienced operator can quickly evaluate size, depth, and magnetic characteristics of buried objects.

A quotation for purchase on this audio accessory is enclosed.

We appreciate your continued interest in our products and wish you good luck in your explorations.

Sincerely,

J.P. van Krieken
Application Engineer
Quantum Electronics Division

JPvK:mlb
Enc: Quotation

January 3, 1968

Dr. Sheldon Breiner
Quantum Electronics Division
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Shelly,

Now that the new year is here, I have started to think realistically about our plans for field surveys. They are tentatively as follows:

1. Varian Associates.
   Winter, 2 weeks, Mexico.
   The exact time has not yet been decided, but could be in January, February, or March. If you will let us know which 2 weeks are best for you, that will help in making the decision.
   The site is at San Lorenzo about a 100 miles south and west of Vera Cruz. (Dr. Michael Coe, Yale University, who knows more precisely, is still on vacation).

2. University of Pennsylvania, E. K. Ralph, etc.
   a. May - Elis, Greece
   b. 1/2 June - other sites, Greece
   c. 1/2 June - Dun Ailinne, Ireland
   d. July - Indian sites, Michigan
   e. September ? Sibaris or other Italian and Greek sites.

Now, about expenses, We have submitted a grant proposal to the NSF, but will not know definitely about funds until mid-April or May, probably the latter. In the meantime, Fro Rainey will find $2,400 from some "pocket" or other for your part in the Mexican survey. The problem is that not enough money will be available to purchase the Model V-4971 Portable Search Magnetometer before I have to leave for Greece. Do you suppose we could lease it and pay for it later if the grant comes through or if not, pay a minimal rental for its use in May, June, and July? This sounds a bit informal, but would suit us best under the circumstances.

With best wishes to you, Doug and Frank for a Happy New Year,

Beth K. Ralph

March 5, 1968

Dr. Sheldon Breiner
Analytical Instruments Division
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Shelly,

Apparently, the University of Pennsylvania cannot issue a purchase order for consulting services, and they suggested that this accompanying letter might serve in lieu of one.

At any rate, I have enclosed a check for $2400.00 to Varian Associates for geophysical services at the San Lorenzo site in Mexico, of approximately two weeks' duration, in March, April, or May 1968. This check is to cover the cost of your services and an assistant and the use of one or more cesium magnetometers.

It was good to see you last week.

Best regards,

Elizabeth K. Ralph

EKR/abn

Air Express

August 14, 1968

Mr. Bob Stout
Analytic Instruments Division
Building 4
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Mr. Stout:

By air freight I am sending you the following:

A. property of Varian Associates
   1. One Audio Indicating Magnetometer including ear phones
   2. One Cesium Sensor #49-538-55
   3. Three 6-volt batteries and carrying strap
   4. Bag of spare parts
   5. One Halliburton suitcase
   6. Coaxial cable
   7. One instruction book
B. property of the University Museum
   1. One Cesium Sensor #49-544-93

The audio unit seems to be working, but sockets for both battery and sensor are loose.

Both sensors tend to be unstable, especially, our # 93. The last thing that I did with #93 was try to adjust the oscillator and found the setting extremely critical. It may now be out of adjustment. After repair, please test sensor #93 in a gradiometer arrangement to make sure that it is stable. It has been varying by anywhere from 10 to 2,000 gammas.

I shall appreciate it if you will return sensor #93 as soon as possible.

Sincerely yours,

Beth

Elizabeth K. Ralph

EKR/mhr

September 6, 1968

Dear Mr. Ginzton:

Our Information Office in the Applied Science Center of the Museum has just sent on to me this clipping about the Philco system of interpreting aerial photographs, and since I remember that you said Varian was interested in this sort of thing, I wonder if we could send on to your people there a few aerial photographs, both normal black and white and infrared, in the 7000 engstrom bands, to see if they can make anything out of them. I should explain that these photographs have been made over the site of Sybaris where we know there are a lot of buried buildings, but so far we have been unable to detect them on these aerial photographs. During this summer with the new power driven drill, we have located a lot of stone structures buried below four meters, and we have excellent aerial photographs of this precise area. Shelly Breiner knows all about this and could certainly help with interpretation.

Wally and Mary Stegner have been with us in Vermont for the past few weeks and I believe they are both keen on a look at the Olmec sites early in the coming year, hopefully with you and Mrs. Ginzton. I have tentatively agreed to take over the survey of La Venta also which is being excavated by the University of California.

All best wishes.

Sincerely,

Froelich Rainey
Director

Mr. Edward Ginzton
Varian Associates
611 Hansen Street
Palo Alto, California

FR/jt
Enclosure

FGR 5/1/69

Xeroxes to
Coe, Carpenter & Ralph

varian/611 hansen way/palo alto/california 94303/u.s.a./415/326-4000

April 25, 1969

Dr. Froelich Rainey
The University Museum
University of Pennsylvania
Thirty-Third and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Dr. Rainey:

I am writing in reply to your letter of April 3, in which you expressed your concern over the results of the recent San Lorenzo survey operations. I am sorry not to have written earlier, but I thought it best to contact Sheldon Breiner before writing, and he has been out of town.

Firstly, I think that our apologies are in order for what Beth Ralph calls in her report our "incomplete planning and construction". We certainly could, and should, have given more attention to the assembly and test of the system we provided you, and I regret that this was not done.

However, without in any way trying to make excuses for the poor performance of our equipment, it does seem that this would not be a contributing factor in the location of only eight anomalies by this year's survey--which is, as I understand from Martin Packard, the subject of most concern to you. The Cesium magnetometer is, by its nature, a "go/no go" type of instrument which, when it is working, will perform to its standard specifications and sensitivity. I discussed the problem yesterday with Sheldon Breiner and, while he was also puzzled by the results obtained, he did suggest that the cause may have been the fairly widely-spaced 2 meter x 2 meter grid pattern which was used in the survey. He feels that this could cause one to miss a number of the small, near-surface anomalies of the type that were picked up in the first survey. I believe that Sheldon intends to call you to discuss this with you personally.

On another subject, all the equipment (i.e. both Varian's and the University of Pennsylvania's) which came back from Mexico has now been repaired and is operating satisfactorily. As it happens, only fairly minor repairs were required.

In order to satisfy your instrument requirements for this summer's surveys in Europe, I would like to propose the following course of action:

1) Varian will provide, on a loan basis, a complete V-4971 search magnetometer consisting of Cesium sensor, audio readout and battery charger. This will, in fact, be one of the units used in Mexico (we do not have any new V-4971's in stock, and our

1) Continued

present plan is to replace the V-4971 with a lighter, more rugged search instrument). However, the unit will be carefully checked and reconditioned and will also be coated with a special paint to reduce its heat absorption.

2) Varian will provide up to two days of service instruction at our Palo Alto facility to any designated University of Pennsylvania personnel. We feel that this is important as it will allow your people to carry out first stage maintenance and repair in the field.

3) There will be no charge for the above equipment and services. In addition, Varian will absorb the repair costs of the Cesium sensor returned to us in March.

I hope that this proposal will prove satisfactory to you and that our equipment will play a role in the success of your surveys this summer. I look forward to hearing from you with your comments as soon as possible so that we can make the necessary equipment disposition.

Yours very sincerely,

Peter Gotla, Manager
Geophysics Product Group
Analytical Instrument Division

PG:le

cc: E. Ginzton
M. Packard

airmail
Special delivery

April 29, 1969

Mr. Peter Gotla
Product Manager for Geophysics
Analytical Instruments Division
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Mr. Gotla:

For the spring and summer field season, we should like to have the loan of the following:

1 Portable Search Magnetometer V-4971 including:
Audio Readout
Cesium Sensor without staff
Small battery charger
Set of batteries in carrying case

We shall appreciate it if you will send these and our sensor #90 and detachable staff and housing this week. I plan to leave for Europe on May 9th.

Sincerely yours,

Elizabeth K. Ralph

VARIAN

May 20, 1970

Dear Ed:

I am enclosing a suggestion for the development of a smaller Cesium Magnetometer made by Beth Ralph who has been using your Magnetometer for sometime now in archaeological experiments. Incidentally, I have just heard from Shelley Breiner who had one of his men using the Magnetomoter for us in Mexico in a continuation of the Olmec studies, and you will be pleased to know that with the Magnetometer they have found by far the best of all those huge sculptures heads so characteristic of the Olmec. Everyone is very excited about it and shortly there will be an article about it in SCIENTIFIC AMERICAN. In any case, we would be very pleased if Varian could take over the development for this improved Magnetometer as suggested by Dr. Ralph. In the meantime, we have here a small portable search unit with a small audio read out that you have had on loan to us for experimental work during the past year. Miss Ralph tells me that Peter Gotla now proposes we return the instrument, or purchase it at about one-half price from Varian. Actually, I hoped that you people at Varian could re-consider this and leave the instrument with us because we are continuing to experiment with it at various sites around the world, for example In Yugoslavia, France and so forth. It seems to me it will be well worth while to have the instrument on loan to the Museum for this kind of experimental testing.

I shall be off again in about two weeks for the south of Italy to begin excavations at another site which we hope was the center of metal working in the South of Italy in the Bronze and Iron Ages. It is a fascinating site, high up in the mountains above Sybaris and may very well explain the wealth of that famous Greek city.

You may also be amused to learn that probably because of all the international publicity Sybaris is now being excavated by the Italian Government at tremendous expense. It requires a major

engineering job and they are doing it all on a grand scale. Frankly I don't think it is worth it but I get a bit of a chuckle realizing what a few news stories will do. Anyway, I am glad we are not paying for it.

All the best,

Froelich Rainey
Director

Mr. Edward Ginzton
Varian Associates
611 Hansen Street
Palo Alto, California

varian/611 hansen way/palo alto/california 94303/u.s.a./415/326-4000

November 16, 1970

Professor Froelich Rainey
Director
THE UNIVERSITY MUSEUM
University of Pennsylvania
Thirty-Third and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Professor Rainey:

In the Spring of 1969 we consigned to you a V-4971 Portable Magnetometer for use in your various exploration activities. It is my understanding it was agreed to continue this arrangement in conversations with Peter Gotla earlier this year.

Since the unit is obviously an useful tool in your work, I am writing to inquire regarding your purchase of it so that it can be a permanent addition to your equipment. Carrying this item as a no-charge consignment loan is both costly and of some nuisance to us. Hence, to convert this into a sales transaction I am able to offer it to you for only $3,450. This is a 40% discount from the full price of $5,750.

I earnestly hope you will be able to take advantage of this offer, but, if not, I must ask that the magnetometer be returned to us so we can endeavor to dispose of it through sale to someone else. I shall await your early reply.

Sincerely,

Arthur P. Kromer

Arthur P. Kromer
Manager
Geophysics Product Line

APK:le

Called 11/20/70
Will call back ~ 1 wk.
mentioned $50K for precision unit.
(Peter Gotla - left)

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December 4, 1970

Miss Elizabeth Ralph
THE UNIVERSITY MUSEUM
University of Pennsylvania
Thirty-Third and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Miss Ralph:

This will supplement my recent letter to Professor Rainey and our telephone conversation concerning the V-4971 Portable Magnetometer (Serial No. 195).

Since our conversation we have considered this matter in relation to the prior development program, which you mentioned. Although the development of the precision gradiometer device represented a sizable expenditure for the University, the actual cost to Varian exceeded the amount paid by you. In view of this and other potential opportunities for sale of the V-4971 now on consignment with The University Museum, the best proposition we can make is to offer the V-4971 to you for a price of $2,500 as mentioned by Mr. Gotla several months ago. If you are unable to place a purchase order for the instrument at this price with us before January 15, 1971, I must ask that you return the unit to us so that we may take other steps regarding its sale.

I'm sure you will appreciate Varian's position in this matter and I sincerely hope that you will be successful in completing arrangements which will allow you to purchase the instrument at the above price which represents a discount of in excess of 50% from the regular selling price for this item. We are offering it to the University Museum at this favorable figure because of our past relationships which we look forward to continuing in the future.

Sincerely,

Arthur P. Kromer

Arthur P. Kromer
Manager
Geophysics Product Line

APK:le

Cs sensor 49-544
Dept. 3360 - ext. 2524
John Michiel ext 2735 May 20 - July
Rented from Joseph Grenier ext 2104, mail stop. D-421
Cs sensor rental @ $500/mo.
arrival May 20th

December 8, 1970

Mr. Arthur P. Kromer, Manager
Geophysics Product Line
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Mr. Kromer:

In regard to your letter of December 4th concerning the V-4971 Portable, Magnetometer, I have talked to Dr. Rainey concerning our possible purchase of it and the accessories in our possession for $2,500.

Dr. Rainey will have to obtain permission from the Board of Directors for the allocation of $2,500 from the budget of the University Museum. We anticipate that this request will be approved, and hopefully, the purchase order will be underway before January 15, 1971.

Sincerely yours,

Elizabeth K. Ralph

EKR/jc

12/9/70 P.S. We have the approval, so I shall start the requisition.

varian/611 hansen way/palo alto/california 94303/u.s.a./415/326-4000

April 20, 1971

Miss Elizabeth Ralph
University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Miss Ralph:

Regarding the forthcoming lease of the 49-544 Cesium sensor, enclosed please find two copies of our standard lease agreement. Please fill them out, sign and return one copy to Varian with your purchase order.

Your attention is called to paragraph 8 which states that the lessee must obtain his own insurance. Could you, therefore, please supply us with evidence of insurability.

As discussed, the lease rates for the 49-544 sensor are $500 per month and we have a unit available for immediate lease.

I am also enclosing a data sheet for the V-4938 magnetometer which has a photograph of the new 49-554 Cesium sensor which has identical operating characteristics as the 49-544 except that it has a smaller optical package.

It was a pleasure talking to you and we wish you success on your project in Corsica.

Sincerely,

Joseph A. Grenier

Joseph A. Grenier
Applications Engineer
Geophysics Product Group
Analytical Instrument Division

JAG:le

Enclosures: 2 Lease Agreements
V-4938 Data Sheet

April 22, 1971

Mr. George B. Peters
Associate Treasurer
University of Pennsylvania

Dear Mr. Peters:

Please purchase in the name of the University Museum a binder to extend three months from May 15, 1971, to cover a valuation of $5000.

The Museum is leasing a cesium sensor #49-544 from:

Varian Associates
611 Hansen Way
Palo Alto, California 94303
Attention of: Mr. Joseph A. Grenier
Mail stop D-421
Analytical Instruments Division

for three months from that date, which will make ample inclusion for transportation time from California.

Mr. Grenier has asked for evidence that the lease of the sensor is insured by us. Could you please send them (and us) a copy of the binder?

It will appear in our Museum insurance notebook under "Binders" as number 13 on the list.

Yours very sincerely,

(Miss) Ellen Kohler
Registrar

July 28, 1971

Mr. Art Backer
Bldg.4, Receiving
Geophysics ProductsLine
Varian Associates
611 Hansen Way
Palo Alto, California, 94303

Dear Art,

The attached audio readout, part of V-4971 search magnetometer (our P.O. no. 31666, dated 12/15/70) seems to be acting up again.

It makes no noise and the voltage indicators do not function. It was originally tuned properly for southern Italy where we were using it so that the problem is more than just the setting of the coarse tuning.

Please send me an estimate of the cost of repairs so that I can send a purchase order. More important, however, is whether you can fix it before September 1, when I shall need to use it in England.

With best regards,

Beth Ralph

ext 2158
415-326-4000

August 26, 1971

Mr. Joseph Grenier
Geophysics Product Line, Mail Stop D-421
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Mr. Grenier:

In checking our accounts today, I found that we had made two payments for the rental of a cesium sensor (Type 49-544), a total of $1023.10 (including shipping) for two months.

That reminded me that the sensor was unusable as I described to you over the telephone -- it operated only in one fixed position, and a change of the order of 1° from that position made it inoperable.

I am wondering if you have had a chance to check the sensor and if we may expect a refund.

Sincerely yours,

Elizabeth K. Ralph

September 15, 1971

Mr. Joseph A. Grenier
Varian Analytical Instrument Division
611 Hansen Way
Palo Alto, California 94303

Dear Mr. Grenier:

In reference to your letter of September 10th to Miss Ralph, she is presently in Europe and will return about the 1st of October, at which time she will no doubt answer your letter and inquiries.

Sincerely yours,

Henry N. Michael
Research Associate

HNM/ek

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September 10, 1971

Miss Elizabeth K. Ralph
The University Museum
UNIVERSITY OF PENNSYLVANIA
33rd & Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Miss Ralph:

I am replying to your letter of August 26 concerning the 49-544 Cesium sensor which the University leased for two months this summer.

I had not forgotten our conversation of some time ago concerning the possibility that the sensor you received was defective, however, as you know summer is the busy season for geophysics and this coupled with personnel vacations prevented us from promptly performing the necessary tests on the sensor.

We have now conducted the tests and we have been unable to duplicate the situation as described in your letter. We have found nothing wrong with the sensor as it has operated normally over its full angle of coverage (approximately 70°). Therefore, in the light of our tests we do not feel that it is justifiable to cancel the two months' billing.

Perhaps, if you could provide us with exact details on your method of operation, we could attempt to duplicate the situation you encountered.

Sincerely,

Joseph A. Grenier

Joseph A. Grenier
Applications Engineer
Geophysics Product Group
Analytical Instrument Division

JAG:le

September 30, 1971

Mr. Joseph A. Grenier
Applications Engineer, Geophysics Product Group
Analytical Instrument Division
Varian Associates
611 Hansen Way
Palo Alto, Calif. 94303

Dear Mr. Grenier:

It seems strange that your people could find nothing wrong with the 49-544 Cesium Sensor. We tried to operate it with the Precision Portable Magnetometer that Varian manufactured for us in 1964 (reprint enclosed). With this Readout, the readings should be completely stable when operated with two sensors in the differential mode, and should show only diurnal changes when operated in a fixed position with one sensor. The rented sensor was unstable and could not be used.

We have another sensor, Ser. No. 195 that we purchased with the V-4971 Portable Search Magnetometer, which is also unstable. Would your group like to examine this sensor? If they are able to find the difficulty, we shall be glad to pay for the repair of our sensor.

Sincerely yours,

Elizabeth K. Ralph

EKR/ek
Enclosure

December 10, 1971

Mr. Joseph A. Grenier, Applications Engineer
Geophysics Product Group
Analytical Instrument Division
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Mr. Grenier:

The enclosed suggestions for a slightly smaller and more rugged precision portable cesium magnetometer were sent to Mr. Geinzton and possibly to someone in your department more than a year ago. As far as I know, we have received no reply to our suggestions.

We anticipate that we might have funds to purchase a new cesium magnetometer in the fall of 1972. Since we have now found lighter-weight batteries, changes in the voltage and current drain are not so important, but we do need the differential feature of our Model 4920 for use with two sensors - preferably smaller sensors than our present ones.

In order to submit a budget for a new magnetometer, we do need to know whether Varian would be interested in building one, and if so, its approximate cost. Could we have this information before Christmas (1971)?

Also, I shall appreciate it if you will reply to my letter of November 9th in regard to our ailing sensor No. 195.

Sincerely yours,

Elizabeth K. Ralph

EKR/ek

January 11, 1973

Mr. Arthur S. Backer
Geophysics Sales and Service
Varian Associates
611 Hansen Way
Palo Alto, California 94303

Dear Art,

Your letter about the audio readout arrived just as I was thinking of telephoning you. I am glad that it it fixed because I am planning to leave for Egypt before February 1st, and would like to take it with me.

I have sent through a requisition for $160.00, and the Purchase Order should reach you soon. However, because of the shortage of time, would you please send it right away to the above address.

Thanks very much.

With best regards,

Elizabeth K. Ralph

ER/sa