MINISTERO DELLA PUBBLICA ISTRUZIONE
DIREZIONE GENERALE DELLE ANTICHITÀ E BELLE ARTI
GABINETTO FOTOGRAFICO NAZIONALE
AEROFOTOTECA

[NO DATE] Dr Rainey

Prot. N. 3294-AM/2 All. .....

Risp. a ..... del .....

N. ..... Div. .....

Roma, ...

Uffici: PAL. DELLE SCIENZE - V.LE LINCOLN, 1 (EUR) - Tel. 596.482
Amm.ne: VIA IN MIRANDA, 5 - Telefono 675.373

Gentile Signorina,

al mio rientro in sede ho trovato la Sua lettera cui mi affretto a rispondere scusandomi per l'involontario ritardo.

Nell'impossibilità di fornirLe i negativi da Lei citati, in quanto ormai facenti parte del catalogo del nostro archeivio, mi riservo di inviarLe, quanto prima, le copie del volo ad infrarosso di Sibari che Le interessano.

Vive cordialità.

IL DIRETTORE INCARICATO DELL'AEROFOTOTECA

(Dr.Isp.Giovanna ALVISI)

Elizabeth K.Ralph
Museum Applied Science Center
of Archaeology -
University of Pennsylvania

January 2, 1969

Dear Bob:

Thank you for yours of December 28. I have just written Bernal saying we will be there by the first of February to work on San Lorenzo, and I have asked him if he wants us to go ahead with some work at LaVenta under your present plan. If so, we will let you know at once.

In the meantime, I am off to Libya and South Italy, returning about the first of February. But in my absence, Beth Ralph will look after the Mexican job since we are now sending her with Sheldon Breiner to work at San Lorenzo. She will be in touch with you after we hear from Bernal.

One more thing on the personal side. I have a young friend named Matthew Hudson, the son of a good friend of mine here in Philadelphia who is studying anthropology at San Francisco University. He wants to go to graduate school at Berkeley or some other one of the University of California branches, and I am suggesting he talk it over with you. I don't really know what to recommend about this young man except to say that he has been on the northwest coast and seems very keen about the northwest coast arda. He is something of a beatnik and I am not sure

about his brains. But at least his intentions are good. I hope you don't mind consulting with this prbspective student and you may refer him to some other branch of the University of California.

All the best,

Froelich Rainey
Director

Dr. Robert F. Heizer
Department of Anthropology
University of California
Berkeley, California 94720

FR/j

January 2, 1969

Dear Dr. Bernal:

I have just heard from Phil Drucker that he cannot go to the LaVenta site this winter, but then there is also a note from Bob Heizer, a copy of which is enclosed. Quite certainly you should decide whether we extend any kind of survey to LaVenta from San Lorenzo. We can do this, of course, if you think it desirable.

I am off tomorrow for the southern Sahara and south Italy, and expect to return here by the first of February. In the meantime, Elizabeth Ralph, the physicist who is the Associate Director of our Applied Science Center, will look after preparations for the San Lorenzo job. She will join with Sheldon Breiner at Varian to work at San Lorenzo with him, utilizing all of our different types of magnetometers on the site, and I have asked her to get a list of equipment to you within the next few days. If it is okay with you, we will expect that Shelly and Beth will arrive in Mexico City about February 1 to get started. Then I will be along in late February with Sam Carpenter, one of our Board members, who is particularly interested in the instruments. I hope by that time you can arrange to fly down to San Lorenzo with us in Sam's plane. It is a four-seat plane with a co-pilot, so there is room for two of us in the flight to Minatitlan. You may also wish to continue with us to San Salvador where we will be beginning another excavation this winter. At that time perhaps we can get together for some sort of news release from your shop about the success of the instruments on the Olmec site which as you know I am anxious to do in order to convince the Americanists that these things really work.

Minatitlan

If there are any questions about this job, please refer to Elizabeth Ralph at the University Museum, who has everything in hand.

Sincerely,

Froelich Rainey
Director

Dr. Ignacio Bernal
Instituto Nacional de Antropologia
Cordoba 45
Mexico 7, D. F.

FR/j

Mex

January 3, 1969

Dear Sam:

I tried to reach you by phone today before getting off to Libya, and found you were away. I have just heard that Phil Drucker did not manage to get the money to do LaVenta this winter, but his colleague Bob Heizer writes that we could just as well go ahead there in collaboration with the Mexicans and I have written to Bernal asking what he wants to do about LaVenta. In any case, we will continueaas planned at San Lorenzo, and Beth Ralph will join Shelly Breiner at that site about the first of February. In the meantime, we have learned of some drastic reorganization at Varian Associates which may make some difficulty for us but in a phone conversation yesterday we agreed that we most certainly will go ahead as planned by the first of February. We are just now sending Varian $6,000 to cover the field costs for the San Lorenzo job. They are supplying a lot of new equipment.

With luck, I should be back here about the first of February, and will then be in touch with you about our trip to Mexico in late February. In the meantime, if you would drop in again on the Applied Science Center here to see how things are going, I certainly would appreciate it.

All the best for the new year.

Yours,

Froelich Rainey
Director

Mr. W. Sam Carpenter, III
1060 DuPont Building
Wilmington, Delaware 19898

FR/j

January 8, 1969

Dr. Ignacio Bernal
Instituto Nacional de Antropologia
Cordoba 45
Mexico City 7, D. F.
Mexico

Dear Dr. Bernal:

Dr. Rainey has asked me to send you a list of the equipment that we are bringing to San Lorenzo. I have been waiting for the list from Sheldon Brainer at Varian Associates, but his has not yet arrived. Therefore, I am sending you the list of equipment that I am bringing and will forward his to you as soon as it arrives.

I am planning tentatively to arrive in Mexico City at 2:49 P.M. on Sunday, February 2nd and to take a flight to Minatitlan at 11:00 A.M. on Monday, February 3rd. If it is better <u>not</u> to arrive in Mexico City on Sunday, I shall appreciate it if you will let me know. I can easily postpone the flights for one or more days at your convenience.

Sincerely yours,

Elizabeth K. Ralph

Sent 3 copies

EKR/mrb

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

January 10, 1969

Miss Elizabeth Ralph
Applied Science Center for Archaeology
University Museum
University of Pennsylvania
34th and Spruce Streets
Philadelphia, Pennsylvania 19100

Dear Beth,

We are prepared to follow through with most of the proposed arrangements for the exploration of the San Lorenzo, Mexico site as outlined in my letter to Dr. Rainey dated July 31, 1968. The effort will be somewhat less, however, with a corresponding decrease in the total price. Varian Associates shall provide a man and magnetometer to map as much as possible of the San Lorenzo mesa as conditions allow within a period of three months beginning February 1, 1969. The price for these services is $9,300 as itemized below:

3 months technician at $1,200 per month	$3,600
3 months lease of cesium magnetometer equipment at $1,500 per month	4,500
Engineering and test of entire telemetering system	1,200
TOTAL	$9,300

Preparation of a report and publication plans will depend on the significance of the magnetic mapping. We should discuss this subject after the field work is completed, perhaps in May of this year.

A field technician, John Parker, has tentatively been selected to perform the work in Mexico. He will be taking the following equipment with him:

A. Two V-4971 portable search magnetometers, Serial #130 and 198 to include: two sensor/staff assemblies, two audio readouts, four battery packs and two battery charges. $11,500

B. Two transistor radio transceivers. $100

C. Spare circuit cards, transistors, electronic components, tools, and miscellaneous service items. $50

D. 500 meters of nylon rope. $100

E. Prototype coupler mixer and extra crystals. $300

Miss Elizabeth Ralph

January 10, 1969

We must buy radios, modify the magnetometers for telemetering and test all systems during the coming two weeks. We would appreciate a prompt purchase order to initiate this work. I will contact you soon regarding more details of the project. By the way, a good hotel in Mexico City is the Bamer Hotel. If you get there early do not miss seeing the Museum of Anthropology and History (Olmec room) which is under the direction of Dr. Ignacio Bernal, the Foti of all of Mexico.

Regards,

Sheldon

Sheldon Breiner
Manager, Geophysical Research
Analytical Instrument Division

SB:bj

cc: Peter Gotla - Varian
John Ahern - Varian

AMERICAN EXPRESS

AMERICAN EXPRESS COMPANY, TRAVEL DIVISION, 1710 JOHN F. KENNEDY BLVD., PHILADELPHIA, PA. 19103
TELEPHONE: (215) LOCUST 8-5500

TRAVEL DIVISION

January 17, 1969

Miss Elizabeth Ralph
The University Museum
University of Pennsylvania
33rd & Spruce Streets
Phila. Pa. 19104

Dear Miss Ralph:

For Mexico you will need a Mexican tourist card and we are enclosing the application, which you please should complete and return to us together with proof of citizenship, and we shall then be in a position to secure the card for you.

In the meantime, we have heard from our people in Mexico City and they are confirming the Hotel Luma from February 2 to 3 at the daily rate of 110 pesos, which comes to $9.00. The Luma Hotel is a first class hotel in the Niza area. It is a clean, well-run, good, budget, tourist-class type hotel.

The Bamer Hotel that you mentioned to me is a modern deluxe hotel and considered one of the most exclusive hotels in the city. If you would rather stay at the Bamer, please let me know.

The address for the Bamer is Ave Juarez 52, and the address of the Luma Hotel is Orizaba 16 and apparently both of the hotels are close to the institute you wish to visit.

Yours sincerely,

AMERICAN EXPRESS TRAVEL SERVICE

B. S. Greene!

(Mrs.) Barbara S. Greene
Travel Representative

BSG:jr

Enc.

January 21, 1969

Dr. Ignacio Bernal
Instituto Nacional de Antropologia
Cordobo 45
Mexico City 7, D.F.
Mexico

Dear Dr. Bernal:

Please forgive me for writing so frequently. For various reasons we think it will be better if we arrive in Mexico City on Monday, February 3rd. I shall be coming via Dallas, Texas on American Airlines flight no. 53 which arrives at 4:00 P.M. Both John Parker and I plan to stay at the Luma Hotel, and will take Mexicano flight MX 623 at 8:00 A.M. Tuesday, February 4th for Minatitlan unless you think it necessary for us to stay longer in Mexico City.

I imagine that all of the details have been arranged for work at San Lorenzo and that there will be a site manager to supervise the workmen, etc. We shall need to run the generator all night to charge the batteries of the magnetometers. I hope that this is possible.

I shall appreciate it if you will send me your telephone numbers, both at work and at home, in case I need to telephone.

Sincerely yours,

Elizabeth K. Ralph

EKR/mrb

Mex

February 7, 1969

Dear Mr. Ginzton:

I have yours of the 5th informing me that Dr. Breiner will be leaving Varian and that hereafter we will be dealing with Mr. Gotla. Sorry about Breiner, since he seemed a very lively fellow in this field, but we most certainly wish to continue our collaboration with Varian on the development of these instruments.

Just now I am back from the Sahara and a month away from the office, and I learned that Sam Carpenter is anxious to make our flight to the San Lorenzo site in Mexico during the period between February 17 and the 25th. Since Ignacio Bernal has also advised me by phone that his people can not get to the site at San Lorenzo before February 15, I will try to have Sam plan our flight in his plan for the latter part of that period, say about the 25th of February. However, Sam is down in Florida shooting, and I have not been able to get him on the phone. In any case, I do hope you can get down there for a look at this operation while Sam and I are there. As you may know, Sam is now Vice-Chairman of our Board and the one most interested in the development of these techniques. Could you let mekknow if it is possible for you to get down there so that we can attempt to coordinate our visit with yours?

Incidentally, Wally advises me by phone that he is having a minor operation and in any case Mary is not up to the trip, so Pen and I regret very much that they will not be accompanying us.

All best wishes,

Froelich Rainey
Director

Mr. E. L. Ginzton
Varian Associates
611 Hansen Street
Palo Alto, California 94303

FR/j

VARIAN ASSOCIATES
EXECUTIVE OFFICES
PALO ALTO, CALIFORNIA 94303 (415) 326-4000

EDWARD L. GINZTON
CHAIRMAN OF BOARD AND
CHIEF EXECUTIVE OFFICER

February 5, 1969

Dr. Froelich Rainey
University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia, Pennsylvania 19100

Dear Dr. Rainey:

I have been informed by Sheldon Breiner that the magnetic survey preparations for the Mexican exploration project are now complete. Judging from the excellent results of last year's feasibility tests, I am sure you will have much success in locating the Olmec monuments.

I regret to inform you, however, that Dr. Breiner is leaving Varian effective February 7. He has assured me that everything is set up for the survey. Mr. Peter Gotla, Product Manager, Geophysics, will assume many of Dr. Breiner's duties and is very capable of responding to any difficulties that may arise. Dr. Breiner will continue to be in contact with Mr. Gotla to follow through with his personal commitment to you on matters related to this survey.

The recent news coverage of the Sybaris project was very well received. Thank you for remembering our contribution. I am keenly interested in following the activities of your unique group and would like to hear more sometime when you are out this way visiting Wally.

With all best wishes,

Sincerely,

E. L. Ginzton/mc

E. L. Ginzton

ELG:mc

cc: Martin Packard
Peter Gotla

Techniques

UNIVERSITY INTRAMURAL CORRESPONDENCE
MUSEUM

c/o Humberto Arredondo Z
Avenida Queredo 288
Mexico 21 D.F.

Mexican Rep

Cable to Michael Coe, Mexico [NO YORK]

Please advise regards infrared photos. Carpenter available for visit Mexico after February 20.

Regards,

FGR

1/25
sjc

1/30 to Coe
c/o Senor Francisco Aguirre
Amelia Riveroe No. 6
Minatitlan
Vera Cruz

102-62.

DIRECCION DE ADUANAS.
Depto. de Procedimientos.
301-I-20300.

313.-9/333683

Importación temporal del equipo que se describe en las relaciones adjuntas.

México,D.F, a 12 de febrero de 1969.

C. Admor. de la Aduana.
Aeropuerto Internacional.
C i u d a d .

Con apoyo en el artículo 337 del Código Aduanero, por el término de seis meses permita la Instituto Nacional de Antropología e Historia, dependiente de la Secretaría de Educación Pública, la importación temporal del equipo que se describe en tres hojas que se acompañan en fotocopias, el cual será utilizado para llevar a cabo exploraciones en el Estado de Veracruz, en la Zona de San Lorenzo, para el conocimiento de la cultura prehispánica que floreció en dicha región; en la inteligencia de que por tratarse de una operación que realizará una Dependencia del Gobierno Federal, deberá considerar satisfecho el requisito de garantía establecido en el artículo 325 del Código invocado.

3 anexos.

Atentamente.
SUFRAGIO EFECTIVO.NO REELECCION.
El Director.

Lic. Gilberto García Camberos.

c.c.p. Instituto Nacional de Antropología e Historia.-Presente.-

VVG/hhm.

January 12, 1969

Dr. Ignacio Bernal
Instituto Nacional de Antropologia
Cordoba 45
Mexico City 7, D.F.
Mexico

Dear Dr. Bernal:

The list of equipment that Varian Associates is bringing to Mexico for work at San Lorenzo has just arrived. It is as follows:

A.	Two V-4971 portable search magnetometers, Serials #130 and 198 to include: two sensor/staff assemblies, two audio readouts, four battery packs and two battery charges.	$11,500.00
B.	Two transistor radio transceivers.	100.00
C.	Spare circuit cards, transistors, electronic components, tools, and miscellaneous service items.	50.00
D.	500 meters of nylon rope.	100.00
E.	Prototype coupler mixer and extra crystals.	300.00

It will be brought from Palo Alto, California, by John Parker as Sheldon Breiner is unable to come.

Sincerely yours,

Elizabeth K. Ralph

EKR/mrb

1/6/69

List of equipment to be brought to Mexico for work at San Lorenzo by Elizabeth K. Ralph, Associate Director, Applied Science Center for Archaeology, University Museum, University of Pennsylvania, Philadelphia, Pa.

	Value
Varian Associates Precision Portable Cesium Magnetometer	
2 Readouts, Nos. 49-116-90 and 49-116-93	$ 5,000
2 Sensors, Nos. 49-544-90 and 49-544-93	$10,000
2 30-volt battery packs	$ 500
1 Battery charger	$ 50
Miscellaneous cables, carrying straps, and minor spare parts	$ 100
Tektronix Portable Oscilloscope Type 321	$ 900
Triplett Model 310 Voltohmeter	$ 35
Miscellaneous hand tools	$ 50
Notebooks, tape measures, etc.	$ 50
Auto Transformer, 110-220 volts	$ 20
Total	$16,705

Note: A Schonstedt Instrument Co. Type GMB-1 Fluxgate Magnetic Locator (Value = $2400.00) may be included. If it is not ready before I leave, it will be brought later by Froelich Rainey.

no

C384453

FORMA DGT-91

SERVICIO INTERNACIONAL

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BR IGNACIO BERNAL, INSTITUTO NACIONAL DE ANTROPOLOGIA

CORDOBA45 MES7DF MES

2VGROUQ PORTALBE SEARCH MAGNETOMETERS $11,500 TWO TRANSITOR

RADIO TRANSCEIVERS $100 SPARE ELECTRONIC COMPONENTS $50 500

METERS NYLON ROPE $100 PROTOTYPE COUPLER MISER $300 THIS EQUPT

TO BE BOUGHT BY JOHN PARKER OF VARIAN AND ASSOC

ELIZABETH RALPH

(1258).

1/6/69

List of equipment to be brought to Mexico for work at San Lorenzo by Elizabeth K. Ralph, Associate Director, Applied Science Center for Archaeology, University Museum, University of Pennsylvania, Philadelphia, Pa.

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Auto Transformer, 110-220 volts	$ 20
Total	$16,705

INSTITUTO NACIONAL DE
ANTROPOLOGIA E HISTORIA
S. E. P.

DIRECCION

CORDOBA 45 MEXICO 7, D. F.

México, D. F. 14 de Febrero de 1969.

A LAS AUTORIDADES CIVILES Y MILITARES
DEL ESTADO DE VERACRUZ:

La portadora de la presente Sra. Elizabeth Ralph del Museo de Philadelphia, va a llevar a cabo una serie de trabajos de investigación arqueológica en la Región de San Lorenzo Tenochtitlan, Ver. Debido a lo anterior, mucho agradeceré las facilidades que le puedan otorgar para el mejor desempeño de su trabajo.

A T E N T A M E N T E
EL DIRECTOR GENERAL DEL INSTITUTO

Dr. Ignacio Bernal

VARIAN ASSOCIATES
EXECUTIVE OFFICES
PALO ALTO, CALIFORNIA 94303 (415) 326-4000

EDWARD L. GINZTON
CHAIRMAN OF BOARD AND
CHIEF EXECUTIVE OFFICER

February 14, 1969

Dr. Froelich Rainey
The University Museum
University of Pennsylvania
33rd and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Fro:

Many thanks for your letter of February 7th. Needless to say, we shall continue to do our level best to be helpful in the development of the instruments and their use, as we have previously discussed.

I would have liked very much to accept your kind invitation to visit the site at San Lorenzo; however, things have conspired against such a possibility, including a meeting of Varian Shareholders and a subsequent Organizational Board Meeting. I would have liked very much to join you, especially since, on a recent trip to Peru, I had some exposure to archeological work and have developed an even greater interest in this field.

I do hope that things go well, and that it will be possible for us to meet in the not too distant future.

With all best wishes,

Sincerely,

Ed/m

E. L. Ginzton

ELG:mc

Cable to
Ralph - San Lorenzo.
70 Viriato da Silveira
Apartado Postal no. 52
Minatitlan, Ver. Mex. MEX

Trip to San ~~Lor~~ Lorenzo aborted because digging not started and Bernal unable accompany us from Mexico City. May return when monuments are uncovered. Please advise how things are going
Zeo

sent
2/27/69

CLASS OF SERVICE

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

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SYMBOLS

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MINATITLAN VER MEX 28 4 1225

S RAINEY UNIVERSITY MUSEUM
33 AND SPRUCE ST

ANTIQUE PHILADELPHIA

MUCH WORK MANY TICKS FEW MONUMENTS FOUND LOCAL COOPERATION

GOOD BUT NO FUNDS NOR INTEREST FRM CITY NO ARCHAEOLUGIST

HERE REQUEST LERMISSION TO LEAVE IN ONE OR TWO WEEKS

BETH..

DUPLICATE OF TELEPHONED TELEGRAM

JT
RS / gpsw mail

SF1201(R2-65)

EV6 7400

Mexico
Olmec.

March 4, 1969

Dear Ed:

It is just as well that you did not manage to join us in Mexico : when we arrived there last week we found that the Mexicans had not yet started the excavation of monuments, so of course most of the fun was missing. Because of this, Sam and I aborted our flight from Mexico to San Lorenzo and agreed with Ignacio Bernal that we would work up a major news story about the Olmec and instrument survey when excavations had proceeded to the point where there were a number of monuments exposed. In the meantime, I have talked with Life magazine and it seems they are keen on sending down a photographer to do a real story on this expedition. At that time I may return, but I must devise some way to avoid flying all the way down there and back in Sam's little Cesna. That is just too much sitting still as far as I am concerned.

In any case, I will keep you advised and it may be that we can still meet there to have the real excitement of seeing the monuments excavated as a result of the survey.

When this season is over, perhaps we can get together on the development of some improved instruments for survey work.

All the very best,

Froelich Rainey
Director

Mr. Edward L. Ginzton
Chief Executive Officer
Varian Associates
Palo Alto, California 94303

1 Olmec

March 5, 1969

Miss Elizabeth K. Ralph
c/o Viriato da Silveira
Apartado Postal No. 52
Minatitlan, Vera Cruz, Mexico

Dear Beth:

I just have your telegram which is a bit puzzling, but at least I understand about the ticks. Navaretti, the archaeologist, in charge for Mexicans should certainly be there by this time and we will look forward to some exciting excavation of new monuments, so I do hope you can find a lot of them. As you know, Bernal wants to move them out right away. I agreed with Bernal that we would build up a good news story as soon as Navaretti excavated some important monuments, and Marion Steinman at Life magazine expects to send some Life photographers there as soon as a report from Bernal is in that the monuments are turning up. Your request about returning here in two weeks leaves me a little bit surprised, because we are exceedingly anxious to chart all the stone constructions in the whole site so we can get some idea of the structure of an Olmec town. This is the primary goal, and we certainly want to acknowledge that if at all possible. So, do let me know how things are going with the instruments and whether you have the chart of the survey made last year by Breiner. We can decide later about how long it is necessary to continue.

Also, Bill Kohler and a friend will be arriving at San Lorenzo about March 19 to stay anywhere from two to four days, making a film and photographs of Olmec monuments on the site. Can you arrange for the two of them to be put up there, say between March 19 and March 21 or 23? I will try to arrange that they do not collide with the Life photographer. If things turn out well, it may be that Mike Coe or I or both will come down with the Life people, but of course this all depends on what you turn up there and for that reason I hope you will keep me posted. Sorry we did not get down there as planned, but it seemed rather pointless since both Sam Carpenter and I have been on the site, and there is nothing much to see unless Navaretti had already been digging for a week or two. Please give Paco our very best regards, and Navaretti, if he is there.

All the very best,

Froelich Rainey
Director

FR/j

P. S. I am most anxious that Bill get good photographs of the instruments in operation and particularly of the new experiments being carried out by Varian. I have not yet heard from the people here with the new instrument which Bill is supposed to bring down but I will look into that.

Yours,

FGR

OLMEC

c/o Viriato da Silveira
Juarez 53, Apartado 52
Minatitlán, Ver.
March 9, 1969

Museum Applied Science Center for Archaeology

Froelich Rainey, Director — Elizabeth K. Ralph, Associate Director

THE UNIVERSITY MUSEUM • UNIVERSITY OF PENNSYLVANIA
33rd & SPRUCE STREETS • PHILADELPHIA, PENNSYLVANIA 19104
594-7400 (Area Code 215) — Cable Address "Antique"

Dear Fro,

Things have improved here since I sent off a reply to your telegram. We are now finding more anomalies, in fact, a great many in one area. Paco Beverido, whom Dr. Bernal sent to set up the camp, is excavating one and it appears to be one of the largest Olmec heads, over 2 meters long. He is excavating a la Spinella, and I just hope he has Dr. Bernal's permission. According to Paco, Navarette isn't coming.

Paco disappears to Minatitlán or elsewhere half the time and that makes it difficult especially when we need extra workmen to clear brush – it's not the season for burning. Also, we revert to our stable diet of beans, rice, and eggs for too many meals.

Shelly's new equipment is mostly a failure, but we are managing to keep 2 single sensors moving almost every day. I plan to stay about 2 more weeks.

With best regards,
Beth

Please note complete address → c/o Viriato da Silveira Olmos
Juarez 53, Apartado 52
Minatitlán, Ver., México

March 12, 1969

Museum Applied Science Center for Archaeology

Froelich Rainey, Director — Elizabeth K. Ralph, Associate Director

THE UNIVERSITY MUSEUM • UNIVERSITY OF PENNSYLVANIA
33rd & SPRUCE STREETS • PHILADELPHIA, PENNSYLVANIA 19104
594-7400 (Area Code 215) — Cable Address "Antique"

File

Dear Fro,

Your letter arrived on the same boat on which mine left. Navarrete is still not here, but Paco is now doing 4 excavations. So far, we have covered 170,000 square meters at 2-meter intervals and have found only about a dozen good anomalies. One of these is the big head but 2 of the others consisted only of broken reused basaltic rocks with late pottery associated. At the moment, there's only the new head for Life to photograph. There are holes and pits all over the place, and in my opinion, the place has been worked out. I suspect that a lot of people have been busy with "spillos" in the wet season.

To complete the whole area, it would take, at least, two months if it were clear, and if this has to be done, it seems to me it would be much more sensible to do it after it has been burned over, and they refuse to do this now. We have covered all the open and semi-open areas and after 2 more days, will be held up waiting for cutting paths. Since Dr. Bernal insisted that we make a plan of the site & not mark anomalies on the ground, we can't go hit or miss in the jungle as Shelly did. If we are held up for a few days, we're planning to take a look at La Venta. In the meantime, also, I have to do the surveying. Our first grids are all askew because we expected you to bring the transit that Dr. Bernal was providing.

We don't have Shelly's chart and I'll be surprised if he has yet completed it. Not only is the design of his new equipment impracticable, it is completely inoperable. Also, one of our sensors which Varian just repaired is no good and the new batteries which we purchased from them are no good – actually used-to-death and sold as new. The magnetometer division at Varian must be on-the-rocks and Shelly is too busy worrying about his own future.

If you want me to do the surveys in Italy, France, and Yugoslavia, I'll need, at least, a month at home to order new parts and get our equipment in order. Fortunately, here the anomalies are so strong that we can work with single sensors.

(over)

Please note complete address

Museum Applied Science Center for Archaeology

Froelich Rainey, Director — Elizabeth K. Ralph, Associate Director

THE UNIVERSITY MUSEUM • UNIVERSITY OF PENNSYLVANIA

33rd & SPRUCE STREETS • PHILADELPHIA, PENNSYLVANIA 19104

Area Code 215) 594-7400 — Cable Address "Antique"

If Bill Kohler can bring the new fluxgate, that would be fine. We'll expect him on the 19th. If he is not coming, please let us know.

Beth

Dear Fro,

Your letter arrived on the same boat on which Wine left. Navarette is still not here, but Paco is now doing excavations. So far we have covered 170,000 square meters at 2-meter intervals and have found only about a dozen good anomalies. One of these is the big head but 2 of the others consisted only of broken burned basaltic rocks with little pottery associated. At the moment, there's only the new head for Life to photograph. Then one holes and pits all over the place, and in my opinion, the place has been worked out. I suspect that a lot of people have been busy with "spillos" in the wet season.

To complete the whole area, it would take, at least, two months if it were clear, and if there has to be done, it seems to me it would be much more sensible to do it after it has been burned over, and they refuse to do this now. We have covered all the open and semi-open areas and after 2 more days, will be held up waiting for digging permits. Since Dr. Bernal insisted that we make a plan of the site & not merely anomalies on the ground, we can't go it or miss in the jungle as Shelly did. If we come held up for a few days, we're planning to take a look at Lalanda. In the meantime, also, I have to do the surveying. Our first grids are all askew because we expected you to bring the transit that Dr. Bernal was providing. I

We don't have Shelly's chart and I'll be surprised if he has yet completed it. Not only is the design of his new equipment impractical, it is completely inoperable. Also, one of our sensors which Vernon just repaired is no good and the new batteries which we purchased from them are no good - actually used-to-death and sold as new. The magnetometer division at Vernon must be on the rocks and Shelly is too busy worrying about his own future.

If you want me to do the survey in Italy, Tiwanaku, and Yugoslavia, I'll need, at least, a month at home to order new parts and get our equipment in order. Fortunately, here the anomalies are so strong that we can work with single sensors.

(over)

March 13, 1969

Dear Beth:

I just have your letter of March 9th and am glad to hear that things are going somewhat better. Bernal and I talked on the telephone yesterday, and he is much embarrassed about Navarette. He seems very elusive indeed. However, Bernal still promises that Navarette will get there right away. What this meansil don't know. This is all very upsetting, because as you know our primary object at San Lorenzo was to try to do a total survey of an Olmec site to see what the general structure is, and without Navarette I doubt that this is possible. Do you have the magnetometer charts that Shelley made last year and the detailed map of the site made by Mike Coe? Certainly both these would be essential for the job we are supposed to be doing at San Lorenzo this season. Also, Marion Steinmann who is doing the article on Sybaris for Life is most anxious to do a big sotry on the Olmec and of course two things are important to them. First, the total survey of the site with the new instrument, and second, the excavation of some new and important monuments which would be cheesecake for the photographer. I agreed that I would advise her as soon as we had enough material showing up and when we were sure we could make a survey of the whole site so that we can get the photographers down there. Bernal and I thought yesterday that the time was not yet ripe, but I hope if both things really come off and Navarette gets there that you will cable me at once so that I can advise Marion.

I can imagine that beans and rice get boring, and that San Lorenzo is not as much fun as Sybaris where you were better acquainted, but in the long run it may be very much more important. In any case, with luck this site should convince American archaeologists that our new gadgets are really worthwhile.

It is too bad that Shelley's new equipment is not working out because I have just had a most enthusiastic letter from Ginzton saying that he hopes to

continue their collaboration with us in developing new instruments and we are just waiting to see what success they have with this new stuff before going on to develop something else.

Sam Carpenter seems to want to fly right back to Mexico and Central America, but after travelling for the better part of two months, I have a strong inclination to stay here and tend to my business for awhile. But if things develop well there, a return trip will certainly be tempting. Do let me know how things are going and don't hesitate to cable either good or bad because I feel my communications with Bernal are sort of removed from the actual site and not really up to date. He is, however, very enthusiastic about the new head you have just found.

All the best,

Froelich Rainey
Director

Miss Elizabeth K Ralph
c/o Viriato da Silveira
Juarez 53, Apartado 52
Minatitlan, Vera Cruz
Central America

FR/j

Olmec file

24 March 1969
c/o Viriato da Silveira
Juarez 53, Apartado 52
Minatitlán, Ver., México

Museum Applied Science Center for Archaeology

Froelich Rainey, Director — Elizabeth K. Ralph, Associate Director

THE UNIVERSITY MUSEUM • UNIVERSITY OF PENNSYLVANIA

33rd & SPRUCE STREETS • PHILADELPHIA, PENNSYLVANIA 19104

594-7400 (Area Code 215) — Cable Address "Antique"

Dear Fro,

Paco has just returned this evening from his usual "weekend" exodus. He reports that Dr. Bernal is not coming, but that he and a young assistant, Roberto Gallegos, are instructed to excavate all of our anomalies. At the moment, we have only 3 more that they haven't uncovered. The ones uncovered are the head, a column, and a workshop - probably where they cut the stones.

This week + last, we have 30 workmen cutting the brush, and they are keeping just ahead of us, but in all of this newly cut area, we haven't found a single anomaly. At any rate, it has reduced the tick population.

John Parker and I are planning to leave on Sunday, March 30th. Expect to be at Hotel del Tropico, Minatitlan (Tel. 4.00-78, 4-03-42 y 4-04-88) Sunday afternoon and at Hotel Luna, Mexico on Sunday evening. Will plan to talk with Dr. Bernal on Monday morning, and hopefully, get flights to USA on Monday afternoon.

Spring has come here with a vengence this week. It is even hot at night.

Hope that these plans are O.K. with you.

Tanti saluti,

Beth

CESIUM MAGNETOMETER PROBLEMS ENCOUNTERED IN MEXICO, February to March, 1969 by Elizabeth K. Ralph.

University of P nnsylvania Precision Portable Cesium Magnetometer Model 4920

1 Readout no. 49-116-90 o.k.

1 Readout no. 49-116-93
Three Shelly lights (which form the numbers) don't work and the difference circuit may be unstable.

1 Cesium Sensor No. 49-544-93 o.k.

1 Cesium Sensor No. 49-544-90
Sensor became inoperable in hot weather and then ceased to function even at 70° F. ambient temperature. Suspect thermistor and associated temperature control circuits are bad or out of adjustment.
This sensor was repaired by Varian Associates, order date 1/2/69, Order No. 31-51071K, U of Pa No. 80877.

30-volt battery pack -- purchased from Varian Associates about September 1, 1968. Batteries were found to be old and used up.

Varian Associates Experimental and Rental Equipment

Supplied:
2 V-4971 portable search magnetometers, serial nos. 130 and 198 which included 2 sensors, 2 audio readouts, 3-1/3 battery packs and 2 battery chargers
2 transistor radio receivers
1 prototype coupler mixer
various spare parts

Cost to U of Pa:

Salary for John Parker (not a regular Varian technician nor any training for fieldwork, but a good worker)	$2400
2 months lease of above equipment	3000
Travel and expenses of technician	600
Total:	$6000

/contd...

Results:

Experimental Differential System

This idea was good, but both the planning and construction were incomplete. Also, hardly any of the components operated in warm temperatures, even 80°F. To be practical in the field, an additional set of transmitter and receiver were required to direct the movable sensor carrier. The equipment supplied had been thrown together in great haste and was not rugged enough for field use. Also, the numerous components in small boxes were awkward to carry. The heat affected the signal receivers, the mixer operated erratically, and the base sensor drifted at first, then ceased to function.

Single Sensor model V-4971

The only components which functioned with out drift or complete breakdown were the unmodified audio readout and one of the sensors (the small one). Fortunately, these comprised a single sensor magnetometer assembly. However, there were difficulties with these.

Audio readout:

Required daily tuning and the control of the tuning capacitor is difficult to reach without removing the case--no external control knobs provided. The circuit cards were mounted too far into the chassis causing short circuits and broken connections.

Sensor

Heater did not shut off when sensor reached operating temperature. Therefore, it was necessary to open the case of the sensor electronics and remove the heater card every day after initial warm-up. Sensor ceased completely when temperature was above 95° F. Sensor head was hotwater proofed and had to be disassembled and dried every time it rained.

Report of Elizabeth K. Ralph (page 3)

University of Pennsylvania Requirements from Varian Associates for field work, spring and summer, 1969

Repair of Cesium Sensor No. 49-544-90 (now at Varian)

Possible repair of Readout No. 49-116-93 (now at U. of Pa.) if it does not operate stably after replacement of Shelly lights.

Return of U. of Pa. demountable sensor staff and housing which has been lost at Varian Associates for more than six months.

Loan of gift of one complete V-4971 search magnetometer (now at Varian) including:

1 audio readout, checked for stability in heat.
1 cesium sensor with demountable staff, also checked for stability in heat
1 battery charger with provision for fast and slow charging.

April 2, 1969

Dear Ed,

We have had some problems at the site of San Lorenzo which completely puzzle me. Last year with Sheldon Breiner and Marvin Harris on the site with the magnetometers, they located some 40 anomalies in less than two weeks, and all five of those excavated were hits. This year Beth Ralph and the man sent down from Varian covered practically the whole site and located only eight anomalies altogether. Both Mike Coe and I think this is impossible and that something went wrong with this year's experiment. I am sending on to Peter Gotla Beth Ralph's report, a copy of which is attached to this. Perhaps after Mr. Gotla has looked this over, I should get out there to discuss with him and other people at Varian what the trouble is, and come to some conclusion about further work on that site. I wonder if it is possible to get in touch with Sheldon Breiner and Marvin Harris, who worked with him last year.

We do have plans for work in France, Italy, and Yugoslavia with the magnetometer beginning in late May, and we are very anxious to get instruments repaired and parts replaced as indicated on the attached report, before undertaking further surveys in Europe. In any case, you might look this report over and let me know as soon as possible if anything could be served by a conference at Varian.

All the very best,

Froelich Rainey
Director

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

FR/j
Enclosure

April 3, 1969

Dear Mr. Gotla:

We have had some problems at the site of San Lorenzo which completely puzzle me. Last year with Sheldon Breiner and Marvin Harris on the site with the magnetometers, they located some 40 anomalies in less than two weeks, and all five of those excavated were hits. This year Beth Ralph and the man sent down from Varian covered practically the whole site and located only eight anomalies altogether. Both Mike Coe and I think this is impossible and that something went wrong with this year's experiment. I am enclosing a copy of Beth Ralph's report. Perhaps after you have looked this over, I should get out there to discuss with you and other people at Varian what the trouble is, and come to some conclusion about further work on that site. Would it be possible to get in touch with Sheldon Breiner and Marvin Harris, who worked with him last year.

Could you let me know if the repairs of instruments outlined in this report can be taken care of before we undertake any surveys in Europe beginning in late May.

All the very best,

Froelich Rainey
Director

Mr. Peter Gotla
Product Manager
Varian Associates
611 Hansen Street
Palo Alto, California

FR/j
Enclosure

April 15, 1969

Sr. Fco. Beverido Pereau
c/o Viriato da Silveira
Apartado 52
Minatitlan, Ver.
Mexico

Dear Paco:

Thank you very much for your good letter of April 9th, and for the news of your successful excavations. I have added these results as a postscript to my report.

My report is ready to send except for photographs of some of the grids. Our photographer has promised to finish them within two days, and I will send a copy to you before the end of the week.

I enjoyed hearing about your good dinner at Valgrande, and I wish that I were there to join you this weekend.

We have been having good spring weather here since I returned with beautiful sunny cool days. In the laboratory, however, there has been too much work to do.

Fortunately, I haven't seen a "garrapata," and my bites are now disappearing. Now and then I think of some of Domitila's specialities. I continue to remember all that you did to facilitate our work and to make our life in the camp as pleasant as possible.

With very best regards,

Elizabeth K. Ralph

EKR/mrb

Fco. Beverido Pereau.
C/o. Viriato da Silveira.
Apartado 52.
Minatitlán, Ver., México.

Abril 9 de 1969.

Miss Elizabeth K. Ralph.
Philadelphia, Penn.

Dear Beth:

Perdón por escribir en español, sería peor si tratara de hacerlo en inglés.

Tenemos varios monumentos nuevos:

La anomalía cerca de la columna descubierta en pozo 6, NO ha dado nada aún.

La anomalía cerca del DREIN (Trough stones) nos ha dado una estela en una piedra verde de mayor dureza que la serpentina, tiene 5.35 M de largo y aproximadamente 60 de diámetro, tiene un ligero relieve típicamente olmeca.

Las anomalías en Group D Ridge que están siendo trabajadas por Roberto (Jeep) han dado la primera partiendo del E, una columna de basalto de aproximadamente 1.80 M de largo por 80 cms. de diámetro, colocada verticalmente y asociada con otros dos artefactos de piedra a manera de sillas; la otra ha dado una hermosa placa rectangular, como de 1 M de largo por 80 cms. de ancho y 25 cms. de grueso con un bajo relieve, similar a la estela hallada por Mike Coe en el mismo sitio hace dos años. No puedo dar mas detalles por que es trabajo de Roberto, y nuestras relaciones no son muy cordiales.

El domingo anterior estuve a comer en el Valgrande de Coatzacoalcos y tomé un "churrasco argentino" (carne asada) con vino tinto "Undurraga" chileno que le recomiendo mucho.

Felicidades y que ya se haya olvidado de la pesadilla de las garrapatas, ...y de Domitila.

Sinceramente suyo.

Paco Beverido

Francisco Beverido Pereau.

CRITIQUE ON VARIAN ASSOCIATES AUDIO INDICATING MAGNATOMETER, MODLE: V-4971, AND ACCOMPANING COMPONENTS FOR USE AS DIFFERENTIAL MAGNATOMETER.

EQUIPMENT UTILIZATION TIME PERIOD: 16 Frb 69 to 29 Mar 69

WEATHER CONDITIONS: HOT & DRY, 95-105 degrees
HOT & HUMID, 90-100 degrees
RAIN

AVERAGE DAILY USE: 6 HOURS

The major problem with the audio indicating magnatometer is poor basic design in both the readout and the sensor.

The following is a list of the malfunctions experienced during the above time period while the equipment was in use at the Olmec Site of San Lorenzo Tenochtitlan, Veracruz, Mexico.

I READOUT:

A. Required daily tuning and the tuning capictor does not have an external adjustment.

B. The circuit cards were mounted too far into the chassis causing several problems.

1. Short circuits
2. Broken connections

C. The readout should be painted white to reflect the heat as when the external temperature exceeds 95 degrees the readout will drift off range.

II SENSOR:

A. Heater will not shut off when sensor reaches normal operating temperature. It was necessary to remove the heater card.

B. Sensor absorbed heat due to chassis being grey in color

and would cease to function when external temperature was above 95 degrees, ie., signal drift, oscilating signal.

C. Sensor head was not water proofed. The least amount of water would cause malfunction. An O-ring on either end would solve this problem.

III EXPERIMENTAL DIFFERENTIAL COMPONENTS

A. The basic concept was good however it is incomplete.

1. Seperate transmitter necessary for readout to preclude calling out of reading from read-out (base station) to portable operator.

B. Numerous component chassis impractical for field work.

1. Heat affected signal transmitters (walkie talkie) causing frequency drift and loss of signal.
2. Mixer operated erratically due to heat.
3. Base sensor extreamly sensitive to heat.

SUGGESTION: Modification of Module 49-116 (Prototype)

1. Deletion of sync circuit.
2. Add audio circuit from V-4971 to 49-116
3. Add transmitter principal as optional mode of operation.
4. Complete testing of sensors under all possible climatic conditions.
5. Retain detachable staff idea.

THE UNIVERSITY MUSEUM
UNIVERSITY OF PENNSYLVANIA
THIRTY-THIRD AND SPRUCE STREETS
PHILADELPHIA, PA. 19104
CABLE ADDRESS "ANTIQUE"
TELEPHONE: EVERGREEN 6-7400
(AREA CODE 215)

ASCA

April 17, 1969

Dear Sam:

Attached is a detailed report on the magnetometer survey at San Lorenzo. Since we have only three or four copies of this and they are going to Ginzton, Coe and Bernal, I hope you can return this to the office or bring it in at the time of the Board meeting.

Let me know what you think of the situation at this point.

All the best,

FRo

Froelich Rainey
Director

Please Return To

What does Varian say?

Mr. W. Sam Carpenter, III
1060 DuPont Building
Wilmington, Delaware 19898

FR/j

April 17, 1969

Dear Dr. Bernal:

Enclosed is Beth Ralph's report of a magnetometer survey at San Lorenzo which was just completed. Both Mike and I are completely puzzled as to why so few anomalies showed up this time as compared with those detected last winter. I have been discussing this with the Varian people and with Mike, and it may be that we will still have to resolve this business with another season at San Lorenzo next winter. Mike thinks it is just impossible that there are so few monuments in that whole area covered this winter, but it could be that Beth is right in assuming that most of them have been dug up by expeditions or by the "clandestini."

In any case, I would still like to pursue at San Lorenzo or other Olmec sites further tests with the cesium magnetometer, and I hope we can work out something for next year. In the meantime, we will continue experiments in Yugoslavia, Italy and France.

All the best,

Froelich Rainey
Director

Dr. Ignacio Bernal
Instituto Nacional de Antropologia
Cordoba 45
Mexico 7, D. F.

FR/j

April 17, 1969

Dear Sam:

Attached is a detailed report on the magnetometer survey at San Lorenzo. Since we have only three or four copies of this and they are going to Ginzton, Coe and Bernal, I hope you can return this to the office or bring it in at the time of the Board meeting.

Let me know what you think of the situation at this point.

All the best,

Froelich Rainey
Director

Mr. W. Sam Carpenter, III
1060 DuPont Building
Wilmington, Delaware 19898

FR/j

April 17, 1969

Dear Mike:

Attached is Beth Ralph's report on the San Lorenzo job this winter. Shelly Breiner keeps promising to send us his report on last year, but so far it has not arrived and we are beginning to wonder if he really has the anomalies actually located on the map.

This looks somewhat better than I thought at first, and Pacco's continued digging does seem to show up some interesting anomalies. Is it possible that Pacco did not go deep enough in his test excavations for some of these anomalies with small magnitude? I will have a talk with Beth about this to see what depth they reached in the test pits.

A copy of this report has gone to Ginzton at Varian for his people, and after I talked with him on the telephone, they are having a powwow hout there with Shelly Breiner, to see if they have some explanation for this inconsistency between the two seasons of investigation. Also, they are putting the instruments back in shape for our experiments this summer, in Italy, France and Yugoslavia. After you go over this, let me know what you think about continued work at San Lorenzo

I have just heard from Beth that Heizer and one of the physicists who worked for us at Sybaris is now at Berkeley and will do an instrument survey in May at LaVenta. It strikes me that Heizer is a rather difficult fellow to work with.

All the very best,

Froelich Rainey
Director

Dr. Michael Coe
Department of Anthropology
Yale University
New Haven, Connecticut

FR/j

April 17, 1969

Dear Ed:

Enclosed is Beth Ralph's report on the San Lorenzo survey which still leaves me a bit puzzled, but perhaps it is better than I first thought. Since we have only two or three copies of this report so far, I wonder if you could send this on to Dr. Packard and Mr. Gotla. After our phone conversation, I spoke with Dr. Packard and he is to let me know what you people make of this. Also, they are putting the instruments in shape for our next experiments in Italy, France, and Yugoslavia. Dr. Packard thought it might be possible to get one of your European representatives to work with us for a time in Europe.

After Mike Coe has a look at this, we will then decide about further work at San Lorenzo next year.

All the very best,

Froelich Rainey
Director

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

FR/j
Enclosure

Xeroxes to Coe, Carpenter, Ralph
FGR 5/1/69

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

Fco. Beverido Pereau.
Avila Camacho, # 183.
Jalapa, Ver., México-

Olmec

Abril 29 de 1969.

Dr. Rainey

Miss Elizabeth K. Ralph.
Philadelphia, Penn.

Muy estimada amiga:

Recibí su amable carta del día 15 y también la copia de su artículo con las fotografías que ya deseo ver publicado y que seguramente causará gran interés entre los investigadores.

Con ésta le envío unas fotos de los últimos hallazgos, pues pienso que le interesarán, en ellas anoto algunos datos necesarios, y si usted desea publicarlas, yo no tendré inconveniente alguno.

Quisiera pedirle que envíe Ud. una carta al Dr. Ignacio Bernal, mencionando mi cooperación en el campo, será posible? Parece que nuestro buen amigo Roberto (jeep) no ha dado buenos informes de mi trabajo.

Ahora estoy en Jalapa, en mi cubículo del Instituto, con una fresca temperatura muy agradable, alguna lluvia por las tardes, pero sobre todo sin garrapatas y sin moscos. Con la familia, los viejos amigos y una buena copa para platicar sobre las aventuras pasadas, ya me siento mejor.

Que se encuentre bién, y no deje de informarme sobre sus próximas investigaciones.

Le recuerda con estimación su servidor y amigo

F. Beverido

May 1, 1969

Dear Mr. Gotla:

I just now have yours of April 25, and I understand that Beth Ralph has been in touch with you by phone.

First, regarding the instruments, I am most pleased that they are ready for the work in Europe this summer so that Miss Ralph can get off early in May, and grateful to you for taking care of this so quickly, as well as for taking care of the costs.

Shelly Breiner has not called about the results of this winter's survey at San Lorenzo and I am also waiting for the opinion of Mike Coe in New Haven, who now has the results of both winters' survey. At this point, Mike believes that we should have another go at that site next winter, and I have written Ignacio Bernal in Mexico to say that I think we should have another crack at that as well as at other Olmec sites in the vicinity. Probably both Dr. Coe and I will be there next winter, and I hope we can arrange with you for a continuation of this experiment. Certainly we will keep you posted on the results of this summer's survey in Europe.

All very best wishes.

Sincerely,

Froelich Rainey
Director

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

FR/i

May 6, 1969

Dr. Ignacio Bernal
Instituto Nacional de Antropologia
Cordoba 45
Mexico 7, D.F.

Dear Dr. Bernal:

I hope that you have received my report of this year's magnetometer survey at San Lorenzo, and that the report is satisfactory. Since returning here, I have been happy to learn from Paco Beverido Pereau that three more anomalies represented significant monuments.

I was sorry not to see you when I left Mexico. I wanted to thank you for having everything so well organized for us at customs and at the camp, and to tell you how much we appreciated all that Paco did for us and for the expedition. Paco is a very capable manager and a delightful person. When our Spanish improved a little, we enjoyed his good company.

Sincerely yours,

Elizabeth K. Ralph

EKR/mrb

May 6, 1969

Fco. Beverido Pereau
Avila Camacho #183
Jalapa, Ver., Mexico

Dear Paco:

Many thanks for your letter and the good photographs. I have written to Dr. Bernal, and I hope the letter does some good.

I'm planning to leave for Italy and Yugoslavia on May 9th, so please excuse this hasty letter.

With best regards,

Elizabeth K. Ralph

EKR/mrb

OLMEC

Julie
Please send copy to Mike Coe
[illegible] 5/20/69

INSTITUTO NACIONAL DE
ANTROPOLOGIA E HISTORIA
S. E. P.
DIRECCION
CORDOBA NUM. 45
MÉXICO 7, D. F.

May 14, 1969

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

Dear Dr. Rainey:

Many thanks for your letter of April 17th and the report and photographs on the magnetometer survey at San Lorenzo. As you and Mike were puzzled, so was I at the very small number of anomalies found in proportion to what we expected. I really don't know the reason, but Mike Coe thinks it may be due to the fact that they did not cover the area where he thinks most of the monuments might be found. Anyway, another Colossal Head and a stela are not things to be despised.

As you may know, Bob Heizer has sent a group of people to do similar work with a similar magnetometer (as far as I could gather) in the pyramid at La Venta. They have just started so I don't have any results yet.

If at all possible I would certainly be delighted for you to have another season with the cesium magnetometer next year. Let me know what happened in the different countries where you are also testing the system.

With my best wishes.

Sincerely,

Ignacio Bernal
Director General

IB/cbc

May 15, 1969

Dear Ed:

I have just been on the phone with Shelly Breiner about the San Lorenzo project in Mexico. He has had a look at Miss Ralph's report of our season there last year, and in brief he believes he can get a lot more data out of this survey utilizing a computer plotting instrument which apparently he has just purchased from Varian. In other words, he believes that Miss Ralph's data can be used to get a lot more information about the location of monuments on that site in this manner, and I am just now advising him that we will foot the bill for replotting the data. $2,000.00 for this job seems rather a lot to me, but Shelly tells me this is simply the cost of doing it, and both Sam Carpenter and I think that we should go ahead with it. Certainly we will let you know what the results are.

Also, in talking with Mike Coe on the phone yesterday, I find that Miss Ralph missed some of the most important parts of the site, and hence there seems no doubt now that both he and I and a good instrument operator should have another crack at this next January or February, and I gather from Shelly that the new and smaller cesium magnetometer which you people built for the Army is just as good or better than the original magnetometer made for us at Sybaris.

By this time, I should be used to these ball-ups in experimental work and I suppose that is the most important part of any such experiment.

In any case, we certainly plan to go ahead, and I do want to keep in touch with you people there for continued development of such search instruments. Incidentally, if any of your people there have an idea about some enthusiastic young man in electronics who would like to work in archaeology, I think it would now be possible to get him on here full-time for just such survey work.

All best wishes,

Froelich Rainey
Director

Mr. Ed. Ginzton
Varian Associates
611 Hanson Street
Palo Alto, California

FR/j

For Beth Ralph

May 29, 1969

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

Dear Fro:

I am writing to confirm our telephone conversation of 15 May concerning our offer to process the data from San Lorenzo which we received in the mail two days ago. We propose removing by computer techniques the time variation effects present on each grid and automatically plotting contour maps of the data using the Varian STATOS V plotter. This work should be completed in July for an estimated price of approximately $2000.

The data plotted by Beth Ralph from San Lorenzo has in it many time variations expressed as long, straight-line contours very apparent on most of the maps. The course contour interval necessary to plot the few large anomalies also prevents accurate plotting of the more subtle features. Many other anomalies implicit in the data are obscured either by the time variations or other discrete offsets associated with the magnetometer or the magnetometer bearer. We propose reconstructing a virtual tie-line across the non-anomalous portions of the maps and using this tie-line as a reference for all the profile lines to bring them to a common level. Contour levels are then determined using a program which has the capability to suppress the drawing of fine detail contours in high gradient areas. This feature widens the apparent dynamic range of the map while at the same time ensuring that the subtle, low gradient anomalies will be portrayed.

The resultant data will then be contoured on a new electrostatic plotting device, the Varian STATOS V, that is many times faster than any comparable plotting device now in use. Another feature of this electrostatic plotter which we are not prepared to utilize at this time, however, is the ability to plot variably shaded areas between contours to display the anomalous areas, enhance any patterns, and allow the eye to discern the more subtle features. A preliminary example of this type of presentation is enclosed.

The above procedures accomplish far more than the presentation of glamorous new computer techniques. The computer and graphic procedures reduce errors, selectively emphasize certain features, and in general present the data in a considerably more interpretable form. Needless to say, there is also a powerful bit of public relations value in the application of the latest computer technology, graphical displays, and spin resonance magnetometry to the exploration of a 3,000 year old civilization.

On a related subject, we shall also be pleased to perform surveys for you if for any reason you require additional support or field-qualified personnel. We also have several new ideas that might prove useful as powerful techniques for exploration. Perhaps you would like to try these some day.

In summary, we look forward to a continued good relationship in developing and applying the most effective techniques to archaeological exploration. We expect exciting results from the computer-plotted San Lorenzo survey and shall keep you informed of progress and developments as soon as they are achieved.

With best regards,

Sheldon Breiner
President

cc: Dr. E. L. Ginzton
Dr. Louis Malter

SB:sk
Enclosure

NOTE: For the purposes of our financial accountability, I would appreciate your signing the attached copy of this letter in the space provided to confirm the work we have already undertaken. I put an upper ceiling of $3000 on the job, but expect the work to amount to $2000.

bcc: SB, WRJ, AE

San Lorenzo

October 4, 1969

Dear Mike:

Just a note to say that I have not heard a word from Shelley Breiner about the computer job on the San Lorenzo data but I will try and needle him on this to see what results he has got. In any case, I still feel we ought to have another crack at that site to resolve some of these problems, and I am convinced it should be done with you there. We have a young English physicist with us now by the name of John Winter, who is currently using these magnetometers in France with some success, and I suspect he would be the one we need on this job, plus perhaps somebody from Varian. In the meantime, your friend out in Colorado called me about the shaft graves and I told her I thought the only practical approach to her problem would be to have our man try out the instruments there in February when you would be in Mexico on the San Lorenzo job anyway. Let me know what you think about all this.

Our MASCA people probably will be in touch with you about some note for the MASCA Newsletter on your trace element analysis experiment.

All the very best,

Froelich Rainey
Director

Dr. Michael Coe
Department of Anthropology
Yale University
New Haven, Connecticut

FR/j

Yale University *New Haven, Connecticut*

DEPARTMENT OF ANTHROPOLOGY

Sept. 12th

Dear Fro:

Many thanks for your fascinating "Location of Archaic Sybaris" — what a neat job!

Is there any news on the computer working — or reworking — of the San Lorenzo magnetometry? I saw an article in the new journal World Archaeology describing just such computer enhancement of similar data.

We are just about to begin trace-element analysis of the San Lorenzo obsidian, using moon-rock equipment kindly given Yale by NASA.

Best regards,

Mike

geoMetrics

914 Industrial Avenue
Palo Alto, California 94303
(415) 321-7610

Remote Sensing and Interpretation

October 7, 1969

Dr. Froelich Rainey
Director
The University Museum
University of Pennsylvania
23rd & Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Fro:

We have finished the computer processing and machine contouring of the San Lorenzo data received from you this past May. I had originally estimated that the work would be finished by approximately mid-July, but the job entailed far more computer program development, actual computer time and man-weeks of work than I had anticipated. Thanks largely to the efforts of Alan Edberg, Lauralee Sabo and Doug O'Brien, the results were, I think, fairly impressive, as you can see by comparing these maps, sent already under separate cover, with the original maps contoured by hand last spring.

The procedures we followed in generating these maps were as follows:

1. Transfer of Data to Punch Cards

The data values for all 31 grids, approximately 80,000 grid points, were first punched on cards. These cards were then processed by the computer to produce a paper printout of the values in the original grid format. These values were then visually compared with the original hand-drawn values for verification and corrected for erroneous readings or card punch errors.

2. Removal of Time Variations

Next the average value for each profile line was computed. The time or diurnal variations were then removed by adding or subtracting a value from each data point equal to the amount by which the average value for that particular profile line differed from an arbitrary datum level established for that entire grid. On five grids the average values of some of the lines were unfavorably biased by large anomalies. In

d = doubtful
g = good

E. Ralph

No. Anomalies Valid on basis of Excavation tests on some

San Lorenzo Computer Interpretation of Magnetic Survey Data

Grid No.	Number of Distinct Anomalies Identified by one observer (S. Breiner)	
	Hand-Drawn Map	Computer-Drawn Map →
1	3	5 3 d.
2	2 none	0 ? none
3	1 none	3 none
4	3 none	6 — 1g, 1d
5	4 1g. 1d.	6 — 1g, 1d.
6	0	0
7	1 none	1 none
8	11 repeated in G14	15 repeated in G 14
9	3 1g, 1d	5 1, g, 1d. - nothing in excav.
10	11 1d.	13 -4 d.
11	11 1g	11 1g, 1d.
12	4 none	5 none
13	6 1g	10 1g, 2d.
14	61 20g	74 20g.
15	6 1g	8 1g,
16	1 2d	1 2d
17	5 1g, 1d	8 1g, 1d = nothing in excav.
18	12 3g, 2d	14 3g, 2d
19	5 1d	4 2d
20	2 1 small	5 1 small
21	3 0	5 good tie sample 0
22	0	1 ?0
23	2 0	4 2 d.
24	2 0	3 0
25	2 0	2 1d.
26	3 0	3 0
27	3 1d	4 1d
28	0	0
29	1 1d	1 1d
30	1 0	1 0
31	-- 1g	not done

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I trust you will be pleased with the results of our work and the future potential of performing such work on other data. You will note that only one sensor is needed particularly if you established one or two tie lines across the profile lines and reduce the data using such computer methods. I think the results will be outstanding and much more usable by the archaeologist. Obviously you have a much enhanced promotional benefit from performing such procedures on your data also. I surmise that cost will determine whether or not you employ such computer processing in the future. In this vein let me also clarify the price picture somewhat to say that our price in the future for a corresponding amount of data points would probably have to be twice that which we asked for this amount of work.

Thank you for your patience in awaiting our results. I look forward to discussing the various points I brought up in this letter.

With best regards,

Sheldon Breiner
President

SB:sk
Enclosures

cc: Beth Ralph

geoMetrics

both the major ones and the subtle ones, and to discern trends. Furthermore, almost the entire significance of the map can be grasped immediately even by an untrained person when portrayed as the perspective view. These views are without question impressive to all who see them. These two perspective views will be included at no cost. We would be interested in hearing, however, as soon as possible, whether you have any further interest in producing any more copies of the maps or in acquiring additional perspective views. We presently have approximately 60 magnetic tape reels tied up for this project alone which we must erase as soon as possible for use on other jobs.

My original cost estimate for this job was $2000, but I had asked you to sign my letter of May 29th authorizing an expenditure of as much as $3000 on this job. I regret to say that I have already received strong reprimands by our business manager because this job cost us over $5000 already. I would appreciate payment of $3000 on the job, the remaining loss I am justifying on the basis of its promotional value as outlined in the following paragraph.

I suggest that we both utilize the excellent results I feel we obtained through:

1. A simple press release primarily for the "Trade Journal type of publication" discussing the computer aspects of these archaeological data and the results that can be obtained using the latest magnetometer equipment, modern computer programs and new plotting techniques all designed for geophysical exploration.

2. Publication of these results in three articles -

   a) Your MASCA Newsletter (perhaps the October issue) written by Beth Ralph.
   b) An article for publication on the computer aspects of these data written by Doug O'Brien and Alan Edberg, and
   c) An article on the archaeological exploration of 1968-69 written by Beth Ralph and Sheldon Breiner (and Mike Coe, if appropriate).

Each article would be submitted where appropriate. We would like to suggest the format of the information we would like to see in print with respect to the press release by sending you a rough draft sometime during the next couple of weeks.

yet still portray those small anomalies in extremely low gradient areas. Bold contours were used for the 5 gamma contour interval and very bold contours at the 50 gamma interval.

6. Automatic Machine Plotting

The final maps were generated by a unique computer plotting device, the electrostatic plotter. This device printed the average sized grid in approximately 1 to 2 minutes, as opposed to the usual 30 to 45 minutes on a digital incremental plotter normally used in computer-generated machine contour plotting.

The maps thus generated are clearly superior to the maps that were hand-drawn. The large diurnal variations were almost entirely removed, thus allowing one to observe the more subtle anomalies. The actual anomalies were more clearly represented by several contour lines and over more than a single data point, thus emphasizing their presence and establishing confidence in their validity. The contours were expressed throughout the map at a much more precise contour interval while retaining the readability of the contour map itself. More anomalies are visible on the machine contoured map than are visible on the hand-drawn map in many of the grids as can be adjudged by the attached summary.

only 11 more doubtful ones

I would suggest that you take the maps sent to you and photographically reduce and print them. Then on one copy simply color the anomalies you consider significant and use these maps to aid the archaeologist at the site. The location of these grids is the same as that of the original maps and thus no location legend is placed on the grids. The orientation of the grids is self-evident when compared with the original grids. You may wish to supply one standard legend with each grid when photographing the grids for reduction and printing.

We are supplying within the next two weeks 2 three-dimensional perspective views of selected portions of anomalies, one from grid 15 showing the altar and a less spectacular section of another grid. The perspective view of a total intensity map used for mineral prospecting is shown on the enclosed brochure which you may best view by opening the brochure to view at one time both the front and back pages. You will note that it is considerably easier to observe the anomalies,

those cases, the average values for the lines were selected as the average value of non-anomalous neighboring lines.

3. Computed Upward Continuation

The values, thus adjusted to a common reference level, were then processed by a sophisticated program, derived from the laws of potential field theory, which computed the values that would have been observed at a level one meter higher than the actual elevation of the sensor. The purpose of this procedure was to reduce the effects of the digital noise level of the readings; decrease the effects of surface magnetic noise; and smooth the very sharp gradients one observes while walking relatively close to shallow anomalies. The result was that an anomalous reading at but one data point was now expressed at several data points with a slightly reduced maximum value. In the original hand-drawn map where a single data point was contoured with no anomalous contours at adjacent points the significance of that single data point was questionable, particularly when at the noise level or when the data point happened to be the value of a contour line. This upward continuation process takes advantage of the subtle changes in neighboring values which in the original hand-drawn map were, for several reasons, not contoured.

4. Bicubic Spline Data Point Generation

The original data values were spaced two meters apart comprising a total of 80,000 grid points which when contoured directly, represented a somewhat jagged, discontinuous and difficult to interpret surface. Holding constant the values of the 80,000 computed points, additional points were then computed using a mathematical technique known as a bicubic spline. A total of 500,000 points were thus established. The data points thus generated were spaced one-half meter apart and observed theoretically at an elevation of approximately 1.6 meters above the ground (0.6 meters while carried plus 1 meter through upward continuation).

5. Computation of Contour Lines and Plotting Machine Commands

Using these 500,000 points, the data were then contoured at a contour interval of 2.5 gammas at a scale of 1" = 10 meters, a scale identical to the original one supplied to us. Automatic suppression of contour lines in regions of very high gradient was also employed to keep the map visually interpretable and

Saulor.

October 14, 1969

Dear Shelley:

You will be getting a check shortly for the $3,000 to cover the making of your magnetic contour maps, since it always takes a few days to get a check out of the University. In the meantime, Beth is reducing these things and putting them together in a general map to compare with the base map at San Lorenzo, and I will send a copy to Mike Coe.

Also, I have written Mike saying I still feel we should finish up that San Lorenzo job next year if he can be at the site himself, because it seems to me important to do a thorough job on one Olmec site to see if we can really get some order in those remains. Moreover, there is some girl in Colorado, who wants to have us look at some shaft graves in western Mexico, and I have told her we would have a look at that also if the San Lorenzo job works out for February. Should we get somebody from Geometrics or from Varian to work with us on this job, and what do you think about this? Also, do let me know if you have some other ideas for the development of archaeological techniques, because I would like to push this along.

All the best,

Froelich Rainey
Director

Mr. Sheldon Breiner
GeoMetrics
914 Industrial Avenue
Palo Alto, California 94303

FR/j

October 25, 1969

Dr. Sheldon Breiner
GeoMetrics
914 Industrial Avenue
Palo Alto
California 94303

Dear Shelly:

OlK. to erase San Lorenzo grids
from tapes.

We now have photo reductions and
are putting the picture together.

Thanks,

Elizabeth K. Ralph

EKR/mrb

~~Techo~~
San Lorenzo

October 31, 1969

Dear Mike:

Under separate cover I am sending on the map of San Lorenzo with the magnetic overlays done by Shelley's computer. These have all been reduced to fit the map, and you will see how the new system emphasizes all anomalies.

There are problems. Shelley recognizes many more anomalies than Beth. I am sending their two lists of anomalies with the map so you can see what I mean. Also, you will note that some overlays are missing, grid #22, #24, and so forth. This is because Beth says there are no anomalies on those grids and it is not worth the cost and trouble of reducing Shelley's grids to fit the map.

I hope you will have a good look at all this, to see if it makes any sense, and then let me know what you think about resolving the whole San Lorenzo magnetometer job. I am willing to send John Winter down there with the magnetometers again, provided you are on the job to locate the anomalies and to make some test cuts as he proceeds. The point is that I would like to complete this job to your and my satisfaction and not have all these loose ends. I think we can finance this in a modest way, and I think Ignacio Bernal also would like to see some results somehow. Do let me know what you think.

All the best,

Froelich Rainey
Director

Dr. Michael Coe
Department of Anthropology
Yale University
New Haven, Connecticut

FR/j

geoMetrics

914 Industrial Avenue
Palo Alto, California 94303
(415) 321-7610

Remote Sensing and Interpretation

Ralph,
How you seen this yet?
Could you get the data to Hedy?
Fro

November 5, 1969

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

Dear Fro:

We are anxious to see the composite or reduced reproduction of the computer-drawn maps of San Lorenzo. After they are reduced either Beth or I can go through all of the maps and mark the approximate depth and size of the readily discernible anomalies (depths: less than 1 meter, 1 to 2 meters, or greater than 2 meters; size: small, medium, or large).

I most certainly believe that the anomalies (those indicated by my tabulation enclosed with my last letter) on the computer-drawn maps are real and I do not see any reason for questioning the validity of these anomalies. Some of the anomalies are very deep or distant but are not among those which I noted on the tabulation as significant anomalies.

Enclosed is a 3-dimensional perspective computer-derived display of the total intensity anomaly over the altar. The anomaly at the edge is a torso, the "hole" is an area of no data over an excavation. We are in the process of generating a more presentable display on the electrostatic plotter.

On my last letter to you, I neglected to mention that the high costs of generating the computer-drawn maps were primarily in the labor of punching the cards and verifying the data, and not in the computer time or plotting. In this regard I most heartily recommend you consider computer-drawn maps from all of your magnetic surveys if Beth can arrange to have the data punched on cards and verified at the University of Pennsylvania using personnel from the University of Pennsylvania. This is a fairly straight-forward task which can be performed even by a high school student sitting at a key punch machine, but is expensive when an industrial firm such as ours undertakes this type of work. If you had punched the cards and verified the punching, the cost to you for all of the San Lorenzo maps would probably have been less than

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$3000, but they would have been well worth it. You would need only a single sensor, not a gradiometer, you can cover much more ground, faster, and could have very presentable maps both for publication and for direct use in follow-up work such as you propose at San Lorenzo this winter.

I very much recommend from a magnetic survey point of view that you follow-up the survey information as follows:

1. Use a magnetometer for detailed pinpointing of the magnetic anomalies at the site using the maps as a guide, particularly the larger anomalies.

2. Site in the location of these anomalies by alidade and planetable so as not to leave tempting stakes in the ground.[1]

3. Excavate as many as practical.

4. Finish mapping the remaining areas, the mounds near the pyramid and perhaps Potrero Nuevo.

Generator?

Research

I would like to suggest that GeoMetrics provide a man well experienced in surveying (Marvin Harris who has surveyed extensively and who performed an admirable job in 1968). GeoMetrics is able to follow-up the work and provide support; we even have a new 0.5 gamma very small proton magnetometer for the job; and we do not foresee any "political" problems for you if you utilized our services instead of Varian's. I do not believe that Varian has the capability of performing these types of services although they are of course very capable of providing good instrumentation. We could provide a man with either our new high sensitivity portable proton magnetometer or a cesium magnetometer for approximately $3000 for 6 weeks work in February and perhaps March.

With respect to new archaeological exploration techniques, I have enclosed a copy of something I wrote some time ago as a method of obtaining two and possibly three different surveys for the price of one utilizing your cesium magnetometers, a generator and a special transistor-switched programming box. In one survey you can obtain magnetic intensity, conductivity (resistivity), and perhaps the "induced polarization effect". Furthermore, the conductivity survey can simultaneously be obtained as a function of the depth in the ground. It is possible that we could develop the system and test it using your cesium magnetometers and the programming box which we could

[1]NOTE: At this site, plowed field sites or others you may wish to consider using buried cow magnets 3" x 1½", detectable forever by you alone with a magnetometer over a circle 10 meters in diameter.

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develop. It would certainly have great benefit at many sites in which magnetic surveys alone prove of no value. Our special interest in it would be related to the application of this technique in mineral exploration, but I think it should prove invaluable in many sites particularly where there are either organic remains or discontinuities in the old ground surface, such as buried paths, walkways, stones or other effects of inhabitation.

We are still interested in a press release for trade journals and the like, and after writing this up would like to send it to you for permission to issue it jointly, or alone, as you decide. It will be related mostly to the geophysical and computer applications, not to the archaeology.

I look forward to hearing from you regarding surveying next season. Many thanks for your very prompt payment.

With best regards,

Sheldon

Sheldon Breiner
President

SB:sk

San Lorenzo

November 21, 1969

Dear Shelley:

Finally I got Mike Coe on the phone after he had a chance to read your letter of November 5th. Mike is all tangled up running the Department of Anthropology there this winter but he, like myself, would like to see this San Lorenzo job finally finished. So he says that he will see Ignacio Bernal at Christmas time and propose that we continue at San Lorenzo in February and March with Mike and me going down there at the beginning for a few days to get the whole thing started, and then leave the job to Paco as the archaeologist and your man Marvin Harris. I will probably agree to put up the $3,000 for the six weeks' job, hoping that Ignacio will ggain come across with some funds to excavate the monuments. In any case, let's assume that this does work out in February and March and that we also send Harris and Paco to have a try at the site in Western Mexico when they finish at San Lorenzo. We can firm this up after Christmas, but I see no reason why it shouldn't work out.

Beth is away on a lecture tour but as soon as she gets back I will hope that she can get the material to you for the press release, that is, the overlay map with the anomalies. Of course, I would like to have a look at the news release which you prepared out there. It certainly does not have to be released jointly, but of course we would appreciate full recognition of the University Museum's participation in the project.

By the way, I am including a summary of the San Lorenzo job in a special article on techniques for the Encyclopedia Britannica's Yearbook and I hope this publicizes the use of a cesium magnetometer. Incidentally, I note that the Royal Ontario Museum has been using a cesium radiometer for underwater research in the Virgin Islands. Apparently they worked this out with McNaughton at Varian.

All the best,

Froelich Rainey
Director

Mr. Sheldon Breiner

FR/i

San Lor.

December 11, 1969

Dear Dr. Bernal:

I have just been talking with Mike Coe on the telephone and understand that he has been talking with you about a continuation of our experiment at San Lorenzo. As you know, I really would like to complete this job and can arrange for the instruments and the operators for February and March in Mexico, if this is satisfactory with you. However, as I told Mike, one of our major problems last year was the absence of a really experienced archaeologist on the site, and hence I told Mike we would go ahead if he himself would get down there to instruct somebody personally on how to handle this experiment at San Lorenzo. Now Mike tells me he will do this but can't remain there, so that he is depending upon an archaeologist in Mexico to continue for the duration of the survey.

Therefore, I suppose this depends on who you can find to handle the job. We, of course, will handle the cost of the operators and the instruments and so forth, and I wonder if you can handle the costs of the actual workmen to excavate monuments. If not, do let me know and I will see what we can do about this also.

In any case, we hope that you will be able to find the right personaand will expect to carry on in February and March. Do let me know as soon as you find the right person.

We also have a request from Betty Bell to try out the cesium magnetometer in Guadalajara where she will be working this winter. I told her on the phone that if this was satisfactory with the Instituto in Mexico and if our plans worked out in San Lorenzo I felt certain we could get our operators and the instruments over there to work a few days with her just to see if the area is practical for magnetometers. Then if so we could do a more thorough job later on.

All the best,

Froeli ch Rainey
Director

Dr. Ignacio Bernal
Instituto Nacional de
Antropologia
Cordoba 45, Mexico 7, D.F.

December 4, 1969

Dr. Sheldon Breiner, President
Geo Metrics
914 Industrial Avenue
Palo Alto, California 94303

Dear Shelly:

Under separate cover, I am sending you two copies of the map of San Lorenzo, blown up to a scale of 1:1000. The grid locations are shown on these copies.

Included with this letter are 2 copies of reduced reproductions of most of the computer-plotted grids. The ones omitted had no anomalies or insignificant ones. The scale of the grids is slightly less than 1:1000, but they fit reasonably well on the map. On your computer plots, before they were reduced, I marked the grid numbers and the direction of magnetic north (except for one of Parker's that was not labelled). Therefore, it should not take you or some "high school student" more than an hour to cut out the grids (set of thin copies) and paste them on the map.

Speaking personally, I do not share yours and Fro's enthusiasm for San Lorenzo, and on the basis of the test excavations last winter, I am quite sure that many of the small anomalies that show up on both the hand and computer plots represent nothing more than previous firepits.

You know Marvin Harris much better than I do, but I am just wondering why he did not do some consistent grids nor rrecord the locations of anomalies found in 1968. From my point of view, I had to start from scratch in 1969 and probably duplicated much of the work that had been done before at the cost of 1000 tick bites plus some dollars.

Fro is now in Tikal, but will be back on Tuesday, December 9th.

Sincerely yours,

Fco. Beverido Pereau.
Avila Camacho, # 119.
Jalapa, Ver., México.

replied 1/20/70

San Lorenzo file

Enero 6 de 1970.

Miss Elizabeth K. Ralph.
Philadelphia, Penn.

Muy estimada amiga:

Ante todo, mis mejores deseos por que este año que está iniciandose sea lleno de satisfacciones para usted.

Hace unos días recibí el Boletín de MASCA y me enteré de su labor en Upsala, Suecia, en el Simposio Nobel, creo que todo habrá sido éxito.

Yo he terminado mi tesis y tendré el examen final en un mes mas; posteriormente es posible que trabajemos el Sr. Squier y yo en la región de Los Tuxtlas, y también en Cerro de las Mesas donde quisiera hacer una exploración con magnetómetros. De no ser así es posible que vaya a México a la Universidad Nacional para trabajar y hacer el Doctorado.

Espero que en alguna ocasión tenga noticias suyas, mientras tanto reciba mi sincera amistad.

Paco Beverido

Paco Beverido P.

CABLE - Sent 2-6-70 4:20 P.M.

Bernal -

Coe and Harris with instruments expect arrive Hotel Majestic Mexico City Feb. 18 plan to leave for San Lorenzo with your people Feb. 19 stop. As last year I am covering costs for Coe and Harris and hope you can cover costs of labor for excavations stop ~~Also Brazil at Variam open that Harris~~

Regards Ramey

file

Saturday, February 7

Dear Dr. Rainey:

I called you this morning, but it was reported to me that you weren't in your office and weren't expected to return until Tuesday, and that your secretary had no authority to disclose your home telephone number, so I could go no further.

We'll return to the field tomorrow, and will be quite unreachable for the ten days or so that we'll be there, so on Tuesday or Wednesday I'll try to get a call through to you from the little back-country town near the site. (I know it has at least one phone.) If I can't reach you, then I'll try to call Mike Coe and find out what's going on, so that I can be sure to have things lined up here in the event that you can send a technician.

Sincerely,

Betty Bell

Betty Bell

Apartado 84
Ajijic, Jalisco, Mexico

western union **Telegram**

508P EST FEB 12 70 PA434 DA143
MXC150 XDC145
MEXICODF 9 NL 12 1335
DR FROELICH RAINY DIRECTOR
THE UNIVERSITY MUSEUM
UNIVERSITY OF PENNSYLVANIA
THIRTY THIRD AND SPRUCE STREETS
PHILADELPHIAPA
YOURS WE DO NOT UNDERSAND TYPE OF PERSON NEEDED
IGNACIO BERNAL

SF-1201 (R5-69)

NIGHT LETTER SENT TO IGNACIO BERNAL
February 10, 1970

Forgot to say our people at San Lorenzo need experienced surveyor to locate anomalies precisely. Also have agreed to test instruments on Mrs. Bell's site. Can you advise her.

Regards,

Rainey

Sent 2-13-70

Someone who can operate plane table or other surveying instrument to locate on present map exact position of object discovered with magnetometer. stop this is for final report and to avoid placing stakes on site.

Regards
Rainey

B- 182539

1970 FEB 12 PM 5 40

Museum Applied Science Center for Archaeology

Froelich Rainey, Director — Elizabeth K. Ralph, Associate Director

THE UNIVERSITY MUSEUM • UNIVERSITY OF PENNSYLVANIA
33rd & SPRUCE STREETS • PHILADELPHIA, PENNSYLVANIA 19104
594-7400 (Area Code 215) — Cable Address "Antique"

April 7, 1970

Mrs. Betty Bell
Dept. of Sociology and Anthropology
Colorado State University
Fort Collins, Colorado 80521

Dear Mrs. Bell:

Dr. Rainey has gone to Europe, so I am replying to your letter of March 31st. I am sorry that there was such a mix-up about Mr. Harris and for the inconvenience that it caused you.

We think that it will be best if we plan to do your survey with our cesium magnetometers next winter, or late fall. Please let us know the exact date that would suit you the best, and we will see if we can manage it then.

Sincerely yours,

Elizabeth K. Ralph

EKR/ek
cc: Dr. Froelich Rainey

July 24, 1970

Dear Mike:

I am just now back from abroad and wonder if you and Shelley have done anything about the article on San Lorenzo. I will be in Vermont during August but Beth Ralph is here at the office if there is any dope you want from ASCA.

Incidentally, I have a note from Mrs. Bell saying she will be working next winter and I have agreed to send the instruments.

All the very best,

Froelich Rainey
Director

Dr. Michael Coe
Department of Anthropology
Yale University
New Haven, Connecticut

December 11, 1970

Dear Mike:

I just have your paper for SCIENTIFIC AMERICAN on the magnetometer job at San Lorenzo and want to congratulate you on a readable account of this business. I hope they take it.

My only comment is that I hope you can make it clear that this was carried out as part of the Applied Science Center program for testing these instruments on different kinds of sites and if possible, identify the Science Center of The University Museum in Philadelphia since the University of Pennsylvania is now getting much confused with the State University in College Park. All this is minor but when the people who finance us read such articles, they are always pleased to have the work clearly identified with their pet institution.

All this reminds me that Sam Carpenter and I are off in January for Guadalahara to meet Mrs. Beal and have a crack at those tombs. Beth Ralph will undertake the job with a new boy we have here in the ASCA and we will use Sam's plane to do some aerial photography of the site at that time.

All best wishes to you and your family for Christmas and the New Year,

Froelich Rainey
Director

Dr. Michael D. Coe
Professor of Anthropology
Yale University
New Haven, Connecticut
06520

Yale University *New Haven, Connecticut 06520*

DEPARTMENT OF ANTHROPOLOGY

December 8, 1970

Dr. Froelich Rainey
The University Museum
33rd and Spruce Streets
Philadelphia, Pa. 19104

Dear Fro:

At long last I have put together Shelly's and my material on the magnetometer work at San Lorenzo. This paper, which I enclose, is being submitted to Scientific American. If they don't accept it, I will rewrite it for Science.

As ever,

Mike

Michael D. Coe
Professor of Anthropology

MDC:eoi
Encl.

MAGNETIC EXPLORATION OF THE OLMEC CIVILIZATION

by Sheldon Breiner and Michael D. Coe

Magnetic surveys were shown to be spectacularly successful in locating Olmec monuments at the site of the oldest known civilization in Mesoamerica

The dream of all archaeologists has been an instrument which would allow them to "see" beneath the surface of the ground even before excavation. Such an instrument has now been developed, and has been successfully tested in the jungle country of southern Mesoamerica.

The term "Mesoamerica" means those regions of Mexico and Central America which were civilized before their conquest by the Spaniards. Of these native cultures, it is now known that the Olmec civilization was the very first, dating from approximately 1200 B.C. to 400 B.C. Olmec sites are concentrated in a relatively small "heartland" along the humid, fertile coastal lowlands of southern Veracruz and Tabasco, although colonial Olmec centers have been found in the central Mexican highlands and in the state of Guerrero.

The Olmec, at least in their jungle "heartland" are best known for their magnificently carved monuments, usually made from basalt and weighing up to 40 tons. Particularly striking are the Colossal Heads, gigantic stone portraits of their rulers, depicted as flat-faced personages with thick lips, always wearing what seem to be protective helmets. In both the monumental carvings and in magnificently fashioned small objects of jade and serpentine the dominant theme is their strange religion, in which the gods are seen as

combining the themes of jaguar with human infant.

Of the four largest Olmec sites in the "heartland," the oldest new appears to be San Lorenzo, located on a side branch of the Coatzacolacos River in southern Veracruz. This center was discovered by Matthew W. Stirling of the Smithsonian Institution in 1945, and quickly proved to have the finest and largest Olmec monuments of all. In the two years that he explored San Lorenzo, not one of the carvings was found in its original position. On the contrary, they were typically encountered at the bottom of deep ravines cutting into the site, or on their slopes, and Stirling concluded that they had been pushed over the side by non-Olmec invaders at some unknown moment in time.

Intrigued by the possibilities on throwing new light upon this ancient civilization, one of us (Coe) began in 1966 a long-term investigation of San Lorenzo, under the auspices of Yale University and the National Institute of Anthropology and History in Mexico, financed by the National Science Foundation. ~~Three~~ Two lines of inquiry immediately opened up. The first was the nature of the site itself, which had never been mapped. When we did so, we discovered that San Lorenzo was a flat plateau about a kilometer and a quarter long in a north-south direction, and that the ravines were man-made. That is, they were enclosed by artificial, ridge-like extensions of the plateau on the northwest, west, and south sides. The ridges themselves were obviously planned, for pairs of them proved to have mirror symmetry, a feature like a mound on one appearing in reflected position on the opposite ridge.

Our second discovery was that the monuments that Stirling had

seen in the ravines had actually eroded out of long lines in which they had been buried in the ridges and elsewhere. Ceramic stratigraphy and radiocarbon dating had shown that about 900 B.C. a tremendous act of destruction had taken place at San Lorenzo. A group hostile to the Olmec rulers had mutilated every single piece of carved stone on which they could get their hands. These were then dragged on to specially prepared floors built on the ridges, and completely covered up by a fill composed of soil, gravel, and other debris.

Now, the discovery of this pattern of buried sculptures was purely accidental, a piece of luck that occasionally turns up on every expedition. The possibility that a great number of additional Olmec carvings still lay under the San Lorenzo soil immediately suggested itself. How would these be found? Having had experience in the use of magnetometers for archaeological exploration, Froelich Rainey, Director of the University of Pennsylvania's Applied Science Center for Archaeology, suggested applying such instruments at San Lorenzo.

Several geophysical techniques involving, for example, magnetic, electrical, seismic or gravity methods have been used in archaeological prospecting. Magnetic surveying has proved to be by far the most practical and useful. Although not a common tool in archaeological kits, magnetometers have been utilized during the past decade at various sites around the Mediterranean (where they helped in finding ancient Sybaris), in England, and in North America.

The magnetic anomalies of significance in archaeological exploration are caused by the contrasting magnetic properties of the object of interest and the soil, water, or rocks which cover them. The amount of the very common mineral, magnetite (an iron-ore) and the

mechanical and thermal history of the object usually determine the size of the disturbance, or anomaly. Various rocks and even soils possess different magnetic properties, i.e. susceptibility and remnant or permanent magnetism. Buried rocks, walls, artifacts of various types, tombs, trenches, and other such items are all detectable under the right circumstances.

The most prominent magnetic anomalies are usually caused by natural materials which have undergone heating. Clay objects such as bricks, tiles, pottery, and firepits attain a remnant magnetism as a consequence of the alignment of magnetic domains in the earth's magnetic field during the process of cooling from a high temperature. Such remant magnetism is also a property of rocks which have been heated in nature, especially volcanic or igneous rocks. It so happens that almost all of the San Lorenzo monuments were carved from such a rock, basalt, which is not native to the area but was laboriously brought in from a source in the Tuxtla Mountains, some 70 kilometers to the northwest.

We had first of all to determine whether or not magnetic surveying would aid the exploration of San Lorenzo, since most sites are in fact unsuitable. In February 1968 Rainey assessed conditions at San Lorenzo and obtained samples of the monuments and of the fill in which they are usually buried. On measurement, their magnetism proved to be 5×10^{-4} and 10^{-5} cgs units, respectively. Thus, San Lorenzo turned out to be an ideal subject since the objects of interest were very magnetic and the matrix was rather the opposite. Further, there were no disturbing effects of deeper-lying rock strata to interfere with the observed anomalies; in fact, there are no "natural" rocks at the site so that all anomalies would be significant.

And finally, San Lorenzo is happily remote from any man-made, vehicular traffic, and other iron and steel interference.

The following month we brought a portable cesium magnetometer to San Lorenzo. This instrument has a sensitivity of 0.1 gamma (10^{-6} gauss) and can be operated in either a "search" or "survey" mode. In the first, we simply take occasional readings visually or audibly, noting the location of the anomaly rather than its amplitude. This mode is useful for rapid reconnaissance, for taking a rapid look at site conditions, or for tracing long anomalies (like a wall). We traversed San Lorenzo on horseback, since the local horses all had wooden saddles and no horseshoes to interfere with the instrument. Almost immediately, we located what turned out on excavation to be one of the finest of all Olmec sculptures, a rain god with its typical Olmec were-jaguar features, lying at the head of buried drain system. Further operation in the search mode resulted in the finding of several more monuments. The archaeologists were as mystified as the local workmen at the uncanny ability of the magnetometer to "see" buried objects.

However, to do a really thorough job, especially to find more subtle or more deeply buried objects, required that we produce a magnetic map of the entire San Lorenzo plateau, a program that was largely completed in the following field season by Elizabeth Ralph of the Applied Science Center of Archaeology. Mapping procedures using the instrument on the survey mode require measurements as much as possible on a regular grid whose dimensions are determined by the probable size and maximum depth of the anomalies of interest. Here we decided to seek Olmec monuments with a minimum size of one cubic

meter, which should produce an anomaly detectable at a maximum distance of about 2 to 3 meters. This suggested a grid interval of 2 meters for the entire surface. We divided up most of the accessible parts of San Lorenzo into major grids 100 meters on a side. In each of these, a person would stand over marks on a rope marked off in 2 meter lengths, holding the magnetometer one half meter above the ground. A total of 80,000 measurements were so taken which were transcribed to field notes or into a hand-held voice tape recorder. Unfortunately, the terrain and dense forest precluded coverage in many areas of the plateau.

There are some problems built in to a survey of this sort. One of the worst is that the measurements show not only the magnetic variations of the underlying monuments and artifacts, but also spurious time variations of the magnetic field. These time variations, which can be micropulsations or diurnal variations, are solar-induced phenomena and make it difficult to sort out spatial from time anomalies. To adjust for this, we computed the average of each line traversed and set all averages to each other, thus removing the long wavelength anomalies of no interest.

Furthermore, the survey results showed the effects of close proximity to many physically small but anomaly-producing artifacts especially stone debris from ancient workships. Also, because of the large grid interval, some buried monuments appeared largely on one grid point and only very subtly on several adjacent points, raising doubts in some cases as to whether that single data point is given significance. In this case, we computed what the magnetic field would have been at an elevation 1 meter higher. In this way, more

points would be involved, thereby establishing more confidence in the location and existence of an object. In addition, the very shallow, small, and insignificant anomalies would be only slightly reduced. This process is known in geophysical exploration as "upward continuation" and is a technique based upon potential-field theory.

Using points 2 meters apart does not produce a very easily interpretable contour map, nor does it allow for very much refinement in the location and character of the anomalies. We therefore computed, from the original 80,000 locations, an additional 400,000 points using a technique known as a bicubic spline, a method for low order interpolation between the already established values. All the points thus computed were used to derive contour maps of approximately 31 grids over the San Lorenzo plateau, an enormous job which was made possible by a very efficient technique of electrostatic plotting. One of the end results was a series of three-dimensional perspective views of the contoured data to vividly portray the complex magnetic field variations that we observed over the relatively simple geometric shapes of the monuments.

The survey occupied three field seasons, during which archaeologists from the Institute of Anthropology and History and from Yale conducted the digging to test the reality of the anomalies discovered by the magnetometer teams. There were, of course, some "dry holes" produced by such features as burned soils or stone workship debris, but most efforts were crowned by success. 17 buried Olmec monuments were discovered which otherwise would have completely eluded even the shrewdest and most patient archaeologist. The majority of these were not in the ridges (where the magnetic survey was incomplete) but up on the central part of the San Lorenzo plateau where we had not

expected to find them. Among them, most impressive were two new Colossal Heads. One of these, Monument 53, was lying face up, and wears a unique helmet embellished with a pair of hands. The other, Monument 61, is without doubt one of the greatest masterpeices of Pre-Columbian art, a perfect and unmutilated sculpture which had been buried in a very deep pit, presumably very early in the San Lorenzo phase; apparently it had been missed by the iconoclasts in their mass act of destruction at the site.

Other stones included stelae, columns (one embellished with a bas-relief scene showing a man and a jaguar), fragments of oblong "altars", and a round "altar". One of the stelae bears a motif completely new to Olmec iconography, a fantastic fish with the head of a jaguar --- we cannot even guess at its significance! The marvellous Monument 52, a statue of the Olmec rain god, has already been mentioned.

The magnetometer is thus a reliable and so far unique instrument for the prospecting of Olmec archaeological sites. In fact, after we had initiated the San Lorenzo magnetic survey, it was tried out with excellent results by Robert F. Heizer of the University of California at the great Olmec site of La Venta. There, the central feature is an enormous clay and earth "pyramid" which he has been able to demonstrate is actually a fluted cone in form, perhaps some kind of effigy volcano. Magnetic exploration of the La Venta "pyramid" indicates that there is a gigantic platform of basalt or serpentine (which is also highly magnetic) not far below the structure's summit. It cries out for excavation.

Under the right conditions, magnetic exploration should be a standard procedure at many archaeological sites around the world.

One possible additional application would be the search for buried features producing "negative" anomalies, that is, points in the ground which have little or no magnetism in contrast to their surroundings. Such features might be the hidden openings of underground tombs, which are relatively common in the New World from western Mexico to Colombia. However, in all cases it should be emphasized that a technician should be present, for the field adjustment of the instrument and the interpretation of the results are still too complex for an untrained archaeologist to carry out by himself.