

BRADDOCK SERVICES INCORPORATED

APPLIED MATERIALS SCIENCE FOR ART AND ARCHAEOLOGY

May 16, 1974

15250 NEW HAMPSHIRE AVE.
SILVER SPRING, MD. 20904
301-384-1128

Dr. Elizabeth K. Ralph
University Museum
University of Pennsylvania
Philadelphia, PA 19104

Dear Dr. Ralph:

Thank you so much for your very kind hospitality last Tuesday in showing me your facility and discussing your work.

It is my hope that this initial visit can develop a mutually beneficial association for exchange of ideas and information. While my business is commercial, my inclinations are still academic, and I am keen to share new developments, such as they may be, with others working in the field. Your group in ASCA is, I think, quite unique in its exclusive attention to measurements and analysis, as opposed to conservation, and parallels my own objectives as a newly organized laboratory.

Thanks again for your generous time. I look forward to continuing discussions.

Sincerely,



Thomas O. Ziebold, Ph.D.
President

TOZ/ajd

~~Geophysics article~~

April 19, 1967

Mr. Jeffrey P. Brain
400 Whalley Avenue
New Haven, Connecticut 06511

Dear Mr. Brain:

I was sorry to hear that you have been so busy, but things are mixed up here too. Now, I am not planning to leave before the second week of May and possibly not until June.

If it is any easier for you, I could show you about the proton magnetometer at my home which is near Princeton - about 40 miles closer to New Haven than Philadelphia. We have to drive out of the city anyway to operate it.

If you come after I leave, please contact Mark Han at this same address. He knows a little about the workings of it and Jeanette Flamm has had some field experience with it.

Best of luck with your generals.

Sincerely yours,

Elizabeth K. Ralph

EKR/gm

JEFFREY P. BRAIN
400 WHALLEY AVENUE
NEW HAVEN, CONNECTICUT 06511

April 15, 1967

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

Dear Miss Ralph:

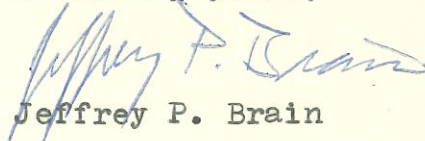
I am afraid events have caught up with me and it will not be possible to visit Philadelphia before you leave for Italy: My generals are from the 21st to the 29th. I certainly regret the conflict, but I suspect that you will probably be happy to have one less thing on your mind at a time when you are trying to get out into the field.

I have read Aitken and other references but additional personal instruction could still be beneficial. Is there someone who could pinch hit for you if I stop by on my way into the field in June (or I could come down in May if necessary)? In any case, whom should I contact after you leave?

I am very sorry if this causes any inconvenience, and I shall certainly cooperate with any substitute arrangements once the pressure is off.

With best wishes for a successful field season, I remain,

Sincerely yours,



Jeffrey P. Brain

March 27, 1967

Mr. Jeffrey P. Brain
400 Whalley Avenue,
New Haven, Conn. 06511

Dear Mr. Brain:

Please excuse me for not replying to your letter of February 10th.

I am now planning to leave for Italy about the end of April. Therefore, if you could come here during the week of April 17th (preferably not on Monday because the Museum is closed to the public on Mondays), that would be best. If not, I may still be here until April 27th.

Sincerely yours,

Elizabeth K. Ralph

EKR:LF

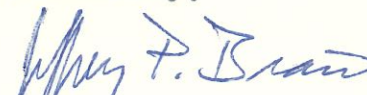
400 Whalley Avenue
New Haven, Connecticut 06511
March 22, 1967

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

Dear Miss Ralph:

As I have not received an answer to my last letter,
I fear it must have gone astray and am enclosing a copy
herewith. Unfortunately, time is now short, and I am
hoping that you will not be departing for the field until
May which would be a better time for me to come down.

Sincerely,


Jeffrey P. Brain

enclosure

C O P Y

February 10, 1967

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

Dear Dr. Ralph,

Thank you for your kind reply to my query. I am most grateful for the generous offer of the loan of a geohm or magnetometer for a week or two in late June or July. For my purposes, the proton magnetometer would be of greater value than the geohm, and it is the magnetometer that I should like to borrow.

I certainly agree that a day of instruction would be most beneficial. From now until mid-April I expect to be quite busy preparing for my Generals and Orals, and I would prefer to come down sometime near the end of April. However, if this is too late for you, or is otherwise inconvenient, do let me know and I shall plan to come earlier--perhaps in March, during Spring vacation. In any case, I should be glad to adjust my schedule to conform with yours.

Sincerely,

Jeffrey P. Brain

C O P Y

JEFFREY P. BRAIN
400 WHALLEY AVENUE
NEW HAVEN, CONNECTICUT 06511

February 10, 1967

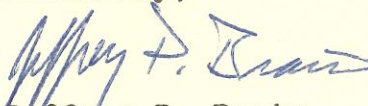
Dr. Elizabeth K. Ralph
Applied Science Center for Archaeology
The University Museum
University of Pennsylvania
33rd & Spruce Streets
Philadelphia 4, Pennsylvania

Dear Dr. Ralph,

Thank you for your kind reply to my query. I am most grateful for the generous offer of the loan of a geohm or magnetometer for a week or two in late June or July. For my purposes, the proton magnetometer would be of greater value than the geohm, and it is the magnetometer that I should like to borrow.

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Sincerely,


Jeffrey P. Brain

JEFFREY P. BRAIN
400 WHALLEY AVENUE
NEW HAVEN, CONNECTICUT 06511

Rolfe
ASCA

January 28, 1967

Dr. Froelich Rainey
Director, University Museum
University of Pennsylvania
Philadelphia, Pennsylvania 19104

Dear Dr. Rainey,

I am a graduate student in anthropology at Yale University. I shall be doing field work for my dissertation at an Indian site in western Mississippi this coming summer. As this site, which is a large Mississippian ceremonial center, is located in the alluvial valley, I am certain from your recent articles that a Geohm or magnetometer would be of great assistance in making a site plan and in locating subsurface features which have been silted over. Can you tell me whom I might contact in order to procure one of these instruments for a brief period in June or July? Naturally, I am interested in loan or rental rather than purchase.

Any and all information that you might be able to supply would be greatly appreciated.

Sincerely,

Jeffrey P. Brain
Jeffrey P. Brain

February 1, 1967

Mr. Jeffrey P. Brain
400 Whalley Avenue
New Haven, Connecticut 06511

Dear Mr. Brain:

Dr. Rainey has asked me to reply to your letter of January 28, 1967.

We have a geohm and a proton magnetometer that probably will be available for you to borrow for a short period in June or July. Which one, would be more suitable depends upon what you are looking for. If you expect to find rather solid walls at depths of less than 2 meters, the geohm would be good. If, however, you are looking for fire pits or other features which offer a contrast in magnetism, the magnetometer would be better.

For most of our work now, we are using a more sensitive cesium magnetometer, but I shall probably have it with me in Italy in June and July. Also, for its use we have to charge \$100 per day plus transportation costs for a geophysicist to run it.

If you do want to borrow a geohm or the proton magnetometer, it would be best if you could come here for a day (before I leave for Italy, possibly in April) so that I could show you how to use them. In the meantime a good reference on these subjects is Physics and Archaeology by M.J.Aitken (Interscience Publishers, 1961).

Sincerely yours,

Elizabeth K. Ralph

EKR/bs

September 30, 1966

Dr. J. R. Bray
Grasslands Division
Department of Scientific and
Industrial Research
Private Bag
Palmerston North
New Zealand

Dear Dr. Bray:

We are, at the moment, processing additional samples of Pinus Aristata, but since these are in process and only a few are completed, I should prefer to send you our results in a few months time.

We have been following your work with interest and I was glad to receive your recent comments about similarity in tree growth patterns in different areas.

Sincerely yours,

Elizabeth K. Ralph

EKR:lm

BROUVER

TELEPHONE: 71-1377

370 6742



University of Queensland

Department of Mining and Metallurgical Engineering
ST. LUCIA, QUEENSLAND, 4067
Australia.

Chet, what do you think?
Both
7/13/76 To be answered by Chet

Both days
Chet for man
Please return
2nd June 1976.
highly suggest
reply
thanks!

Dr Frotlich Rainey,
Director,
The University Museum,
University of Pennsylvania,
Thirty-Third and Spruce Streets,
Philadelphia,
Pennsylvania, 19174,
U.S.A.

Dear Dr Rainey,

I have read with considerable interest, the report in the local press, that an expedition from your University Museum has discovered a Bronze Age civilisation that apparently flourished near Ban Chiang in Thailand, more than 5600 years ago. I also note that a large number of artifacts, including bronze bracelets and spearheads have been brought to your Museum.

I am very interested in metallurgy in archaeology, and have been working in this field for a number of years. During 1969 I spent a 6 months study leave working on historical metallurgy with Dr R.F. Tylecote at the University of Newcastle upon Tyne, in England. Also during 1969, I spent four weeks excavating ancient copper smelting furnaces in the Negev Desert in the south of Israel, with Dr Beno Rothenberg of the University of Tel Aviv. While on study leave in 1975, I spent 8 months at the Institute of Archaeology, University of London, where I carried out metallographic examination of metal artifacts. I then spent three months at the Hebrew University of Jerusalem, where I metallographically examined bronze artifacts from the 14th century B.C. from Israel. A paper¹ covering this work is being published. Since 1972 I have been collaborating with Dr Noel Barnard, of the Dept. of Far Eastern History, Australian National University, Canberra, on the chemical analysis and metallographic examination of bronze figures from South East Asia, held in the Australian National Gallery, Canberra. A paper² covering this work is being published.

In our Department here, we have well equipped metallographic laboratories and an electron probe micro-analyser; we also have a well equipped chemical laboratory, with atomic absorption and X-ray fluorescence equipment, and staffed by qualified chemists.

If you are interested, we would be willing to carry out chemical analyses and / or metallographic examination on any of the bronze artifacts which you have obtained from Thailand, and I would be interested in publishing a joint paper with you, covering this work. We would only need a small sample from each artifact.

For your information my qualifications are briefly as follows:

- B.Sc., in Chemistry and Metallurgy,
University of Melbourne, 1942.
- M.Sc. in Metallic Corrosion,
University of Melbourne, 1956.
- Ph.D. in Physical Metallurgy,
University of Queensland, August 1975.

I am fully qualified in Metallurgy and Chemistry including Analytical Chemistry.

Forwarded herewith for your information is a copy of the manuscript of my paper⁺ on the metallographic examination of metal artifacts from Acre in Israel.

If you would like us to do this work for you, there would be no charge, as it would be part of my research programme at the University of Queensland.

I look forward to hearing from you regarding this matter.

With best wishes,

Yours sincerely,

Colin Brewer

Dr Colin W. Brewer,

Lecturer in Physical Metallurgy.

⁺ Israel paper forwarded separately.

References:

1. C.W. Brewer, "Metallographic Examination of Metal Artifacts Found in Tombs in the Persian Garden, near Acre." Being published in 'Atiqot (Journal of the Department of Antiquities and Museums, Jerusalem.)
2. Noel Barnard, B. Heffernan, C.W. Brewer, W. Hemmy, & W. Ambrose. "Seven Bronzes from Southeast Asia and Indonesia - some applications of science in the study of objets d'art." Part 1: Two Khmer Bronzes. National Gallery of Australia.

 THE UNIVERSITY AT ALBANY

November 20, 1979

Ms Elizabeth K. Ralph
Museum of Archaeology
University of Pennsylvania
Philadelphia, PA.

Dear Ms Ralph:

Your name and address were given to me by an Archaeologist in Virginia several years ago so, it may not be correct today. Anyhow, if the letter reaches you, I will be grateful for a response. I notice that you serve on the Editorial Advisory Board of ARCHAEOLOGY but a letter mailed to that address would probably have to be routed on to you.

As you can tell from glancing through the enclosed resume, I am an amateur archaeologist attempting to switch over to Archaeology from another field. I have negotiated quite a number of short-term experiences which have given me the fundamentals and an appreciation of the complexities involved in the work.

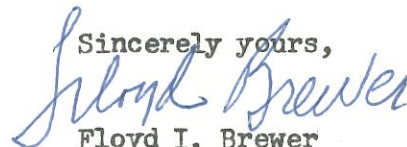
Wherever I've worked or studied, the question of dating artifacts has come up and I am both curious and keenly interested in what laboratories actually do with samples sent in for dating. I have read about thermoluminescent dating, for example, but the half-life/defect trap draining process would be easier for me to understand if I could see a sample being analyzed.

Would it be possible for me to spend a day at the Laboratory reviewing dating processes with a member of the staff?

A research project in my main field (Counseling Psychology) will take me to State College on December 6th. I could stop in Philadelphia early on the 5th on the way down or early on the 7th on the way back. Additionally, I haven't had the pleasure of visiting the University Museum and would like to spend some of the time just browsing.

If you or another member of the staff can spend a little time with me on either December 5th or 7th, would you reverse the charges and call me at home (518 439-6391) please? I am on sabbatical leave and am not checking at my office for messages.

Many thanks.

Sincerely yours,

Floyd I. Brewer
Associate Professor
Counseling Psychology and
Student Development

RESUME

FLOYD I. BREWER
 31 Lansing Drive
 Delmar, New York 12054 U.S.A.
 Home telephone: 518 439-6391
 Office telephone: 518 457-8232

MARRIED: March 21, 1944 to the
 former Coleen Hamilton. Chil-
 dren: Jeffrey H. (1948),
 Mark A. (1950)
 DATE AND PLACE OF BIRTH: May 6,
 1921; Bridgewater, Maine U.S.A.

Height: 5 Ft. 11 in. Weight: 166 lbs. Health: Excellent

EDUCATION: Directed reading in Anthropology, Archaeology, and related disciplines 1972-79

Doctor of Education in College Student Personnel Administration, Teachers College, Columbia University, New York, N.Y. 1956

Master of Arts in Vocational Guidance Teachers College, Columbia University, New York, N.Y. 1947

Bachelor of Science in History Gorham State Teachers College (Div. of the University of Maine) 1943

CURRENT POSITION: Associate Professor of Education, Department of Counseling Psychology and Student Development, Room # 220, School of Education, State University of New York, 1400 Washington Ave., Albany, N.Y. 12222 1966 (to present)

FORMER POSITIONS: Director, Student Union, University of Cincinnati, Cincinnati, Ohio 45221 1956-66

Director, Student Activities & Residence Halls, University of Bridgeport, Bridgeport, Connecticut 1947-56

EXPERIENCE IN ARCHAEOLOGY - Usually 2 to 5 weeks each summer

DATE	NAME & LOCATION OF SITE	ARCHAEOLOGISTS IN CHARGE	NATURE OF THE EXPERIENCE
1972 and 1973	Flowerdew 100 Site Near Spring Grove, Virginia, U.S.A.	Office: Dr. Norman Barka, Assistant Professor & Dir. of Research, Southside His- torical Sites, Inc., Dept. of Anthropology, College of William & Mary, Williamsburg, Virginia 23185 Field: Mr. Leverette B. Gregory	Colonial Plantation - 1618- First owner: Sir George Yeardley, 1st Gov- enor of Virginia. General excavation skills where restoration was the prim- ary objective. Exposure to basic methods of ex- cavation, photography, grid system, test pits..
1974	Wells Bridge Site Wells Bridge, N.Y. U.S.A.	Field: Dr. Robert Funk, N.Y. State Archaeologist, N.Y. State Museum & Science Service, State Education Bldg., Albany, N.Y. 12204 Laboratory: Mr. Charles Gillette, Curator	Native American Indian Site. Exposure to strati- graphic principles in excavation & means of rec- ognizing stone tools. Many hours in laboratory working on artifacts.

DATE	NAME AND LOCATION OF SITE	ARCHAEOLOGISTS IN CHARGE	NATURE OF THE EXPERIENCE
1975	General Post Office Site London, England	<u>Office:</u> Mr. Brian Hobley, Chief Urban Archaeologist, City of London, Guildhall Museum, 55 Basinghall St., London, England EC2V 5DT <u>Field:</u> Mr. Alan Thompson	Roman through Medieval. Developed skill in excavating human and animal bones, cesspits and other features of Roman origin. Some work on artifacts at the site.
1976	Rectory Farm Site Great Shelford, England	<u>Field:</u> Dr. David H. Trump, Staff Tutor, Pembroke College, Board of Extra- Mural Studies, Cambridge University, Cambridge, England <u>Field:</u> Mr. Anthony J. Legge, Lecturer in Archaeology, Churchill College London, England	English farm in continuous use for farming for at least 2000 years. Developed skill in recognizing features via aerial photographs and in using open excavation (layer by layer) techniques. Attended lectures on many archaeological subjects during the evenings
1976	Bredsättra Site Bredsättra, Sweden	<u>Office:</u> Dr. Ulf Erik Hagberg, Uppsala University, Uppsala, Sweden <u>Field:</u> Mrs. Margareta Sjöberg, Box # 43, Tullgatan 20, Borgholm, Sweden	5th Century Swedish home which burned to the ground. Developed skill in working with charcoal remains and in excavating tiny artifacts (beads, etc.)
1977	Abbey Green Site Chester, England	<u>Office:</u> Mr. Timothy J. Strickland, Grosvenor Museum, 27 Grosvenor St., Chester, England <u>Field:</u> Mr. John McPeake	Roman Interval Tower: AD 72 Developed skill in excavation features: drainage ditch, road, rubbish pit. Learned a great deal about Roman pottery.
1978	Draper Site Stouffville, Ontario, Canada	<u>Office:</u> Dr. William D. Finlayson, Director, Museum of Indian Archaeology, The University of Western Ontario, London, Ontario, Canada <u>Field:</u> Mark Borland, Dana Poulton, Ronald Williamson	Huron Indian Village 1500-1530. Experience with rescue archaeology methods: motorized screening of large quantities of soil, use of high pressure water hose on tons of soil dumped in boxes with screen bottoms, helped to strip large areas of land looking for post holes, charting post hole patterns & other features via an excellent record-keeping and computerized system. Some experience with transit.
1979	Lawson Site London, Ontario, Canada	<u>Office:</u> Dr. William D. Finlayson, Director, Museum of Indian Archaeology. <u>Field:</u> Robert Pearce, Martin Cooper	Very short (3 day) experience working on the construction of a native Indian longhouse. Considerable reading about the Attawandarons or Neutrals.

DATE	NAME AND LOCATION OF SITE	ARCHAEOLOGISTS IN CHARGE	NATURE OF THE EXPERIENCE
1979	Prehistoric caves near Bordeaux and Les Eyzies, France; Gallo-Romaine Museum, Lyon, France	Dr. Francois Bordes, Dir. Institute du Quaternaire, Batiment de Geologie, University of Bordeaux I Bordeaux, France Mr. Amable Audin, Conservateur, Musee De La Civilisation Gallo-Romaine 17 Rue Cleberg 69005, Lyon, France	Study tour of area archaeological sites in France; some exposure to site selection techniques, examination of the role of sedimentologists, review of principles of Palynology and a method of analyzing soil samples called "global granulometry." Extensive review of Roman occupation era in Lyon & Vienne.

PROFESSIONAL MEMBERSHIPS: The Archaeological Institute of America, Museum of Indian Archaeology (London, Ontario) - Sponsor, National Geographic Society, Smithsonian Associate.

State University of New York at Albany

12/10/79

Dr. Elizabeth Ralph
David Rittenhouse Laboratory
BW # 4
University of Pennsylvania
Philadelphia, PA 19104

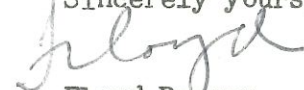
Dear Dr. Ralph:

Just a few lines to extend my thanks for your time and instruction during my visit last week. Through you I also want to thank Anne who was really helpful in taking me through the process. Having read your article in the book you gave me, the C 14 dating process is now easy to understand. Thanks much for the book!

Same story with thermoluminescent dating. Dr. Fleming took me through the process and, now, having read John Winter's article in the book, I can understand the method quite well.

Best wishes and happy holidays to you and Anne.

Sincerely yours,



Floyd Brewer
Associate Professor

OAKLAND UNIVERSITY

Rochester, Michigan 48063

DEPARTMENT OF CHEMISTRY

Area 313 377-2320

September 4, 1974

Dr. Elizabeth K. Ralph
Associate Director
Applied Science Center for Archaeology
University of Pennsylvania
Philadelphia, Penna, 19104

Dear Dr. Ralph:

We are currently setting up a concentration in archaeology at Oakland University and I am at present in charge of this program. In this connection I should very much appreciate an opportunity to visit the Applied Science Center to observe the current instrumentation and practice. I would be interested both in dating methods and instrumentation for prospecting.

I shall be attending the meeting of the American Chemical Society in Atlantic City, Sept. 9-15, and hope to be able to combine a visit to Philadelphia at that time, perhaps Thursday or Friday, Sept. 12th or 13th.

I regret the relatively short notice, but do hope that a visit can be arranged at this time or in the future.

Sincerely yours,



Gottfried Brieger
Professor, Chemistry

September 7th, 1974

Dr. Gottfried Brieger
c/o American Chemical Society
Convention Hall
Atlantic City
New Jersey 08401

Dear Dr. Brieger,

Thursday or Friday, September 12th or 13th will be fine for
your visit to our MASCA labs.

Sincerely yours,

Elizabeth K. Ralph

DEPARTMENT OF CHEMISTRY

Area 313 377-2320

September 18, 1974

Dr. Elizabeth K. Ralph
Associate Director
Applied Science Center for Archaeology
University of Pennsylvania Museum
Philadelphia, Pennsylvania 19104

Dear Dr. Ralph:

I want to thank you and your staff again for the opportunity to visit the MASCA laboratories, and the generous amount of time you spent on this occasion.

I hope to make use of some of this information to set up a modest laboratory here in the future. In the meantime I will reflect on better ways of making benzene from acetylene.

Sincerely yours,


Gottfried Brieger
Professor

GB:bsk

THE BRITISH MUSEUM, LONDON, W.C.1

Department of Research Laboratory

TELEPHONE: Museum 1555

2 Dec '53

Dear Miss Ralph,

I enclose
a reprint of my letter to "Nature"
as promised. I trust you
had a pleasant return
journey and that you
found your apparatus
behaving itself on your
return.

With best wishes

Yours Sincerely
Harold Barker

THE BRITISH BROADCASTING CORPORATION

HEAD OFFICE: BROADCASTING HOUSE, LONDON, W.1

LIME GROVE STUDIOS, LONDON, W.12

TELEGRAMS: BROADCASTS LONDON TELEX ★ CABLES: BROADCASTS LONDON-WI ★ TELEX: 22182

TELEPHONE: SHEPHERDS BUSH 8000

Ralph

Jan 12th

Dear Professor Laming and Miss Ralph,

This is to say again how much we appreciate your help on our Sybaris programme. It has been invaluable and has formed the basis for the greater part of our story. I'm returning the film and slides herewith - trusting they're within the time limit. We found your magazine "Expedition" enthralling - must say I hope our paths cross again sometime soon.

I believe in fact we have the Bodrum
expedition film in colour waiting for

the day late this year when we
start colour television here!

Again to you both my very
sincere thanks and good wishes.

Yours sincerely

Kenneth Shephard.

"Chronicle" - B.B.C. 2.

THE BRITISH MUSEUM
DEPARTMENT OF EGYPTIAN ANTIQUITIES
LONDON WC1

Telephone: 01-636 1555

*return
to EKR*

EA/617/70/AMK

8th June, 1970

Miss Elizabeth Ralph,
The Applied Science Centre for Archaeology,
The University Museum,
33rd and Spruce Streets,
Philadelphia 4, PA. 19104,
U.S.A.

Dear Miss Ralph,

I have been holding your cable addressed to Lanny Bell since the 28th May, expecting to see him and to hand it to him, but he has not yet shown up and I am wondering whether he may perhaps have decided to skip his visit to this country. In any case, I fear there is little chance of him being able to see your cable in time to send you the desired information by the 10th June.

Yours sincerely,

I. E. S. Edwards

I. E. S. Edwards

Keeper.

January 24, 1973

Dr. G. de G. Sieveking, Assistant Keeper
Department of Prehistoric and Romano-
British Antiquities
London WC1B, ENGLAND

Dear Dr. Sieveking:

RE: P & RB/GS

Thank you for writing about the MASCA Newsletter. I have enclosed a copy of the only one which we published in 1972.

I discovered that some one had put the British Museum on the mailing list, but had omitted your name. This mistake has now been corrected.

Your letter reminded me of your request (June 1971) for a magnetometer survey. Are you still interested in this?

I hope to spend one night in London enroute to Cairo about February 14th, and I shall try to telephone you to discuss the survey.

Sincerely yours,

Elizabeth K. Ralph

ER/sa

Enclosure 1

THE BRITISH BROADCASTING CORPORATION

630 FIFTH AVENUE

NEW YORK, N. Y. 10020

January 18, 1967

Dear Miss Ralph:

Many thanks for your help. Here are the slides and film back, I hope in time.

There is a note for you and Dr. Rainey enclosed with the film.

Thanks again.

Sincerely,


Robyn Mendelsohn

THE BRITISH MUSEUM
DEPARTMENT OF EGYPTIAN ANTIQUITIES
LONDON WC1

Telephone: 01-636 1555

EA/213/70/AMK

4th February, 1970

Miss Elizabeth K. Ralph,
Associate Director,
Applied Science Centre for Archaeology,
The University Museum,
University of Pennsylvania,
33rd and Spruce Streets,
Philadelphia,
Pennsylvania 19104,
U.S.A.

Dear Miss Ralph,

Some months ago you asked me to send you the results of our C.14 measurements of the Egyptian samples obtained by Dr. Geoffrey Martin in 1966 and 67. For a number of reasons outside our control it has taken longer than we had hoped to complete the investigation but apart from a very few delta C.13 checks, it is now done.

I enclose the list which will be published with the paper on Egyptian chronology which I delivered in December. You will notice that I have included the reference numbers to the parallel tests by UCLA, the results of which are no doubt available to you.

Let me take this opportunity of thanking you for sending me copies of the MASCA newsletter which I find most useful.

Yours sincerely,



I. E. S. Edwards
Keeper.

Enclosure.

John D. Broadwater
7901 Chowning Circle
Richmond, Virginia 23229

"SERVING YOUR MARINE NEEDS"



TELEPHONE
(919) 457-5388
804-747-0741

June 18, 1977

Applied Science Center for Archaeology
University Museum/Univ. of Pennsylvania
33rd and Spruce Streets F1
Philadelphia, Pa 19104

Attn: Dr. Froelich Rainey, Director

Dear Dr. Rainey:

I read and very much enjoyed your article "New Tools for an Old Art," which appeared in the IEEE Spectrum in September, 1976. I also enjoy the "MASCA Newsletter." I have participated in a number of archaeological projects, mostly projects dealing with underwater archaeology. I assisted Dr. George Bass in a survey in Turkey in 1973 as sonar operator, and I have a degree in electrical engineering.

My reason for writing you is that my local IEEE chapter has invited me to speak to their group on ways in which electronics is aiding archaeologists. I am especially interested in presenting some of the ideas expressed in your article. What I need is some slides or photographs which I could convert to slides, and some additional information which you feel would be interesting to the group. I want to keep the talk very general, and will put some "eye-catchers", such as a picture of the "Loch Ness Monster" in the slides.

If you have any information I can use, or if you have any suggestions as to where I could obtain this type of material, I would appreciate any help you can offer. Again, let me say I enjoyed your article and I am very much interested in your work. I will look forward to hearing from you.

Very truly yours,

A handwritten signature in blue ink that reads "John D. Broadwater". The signature is written in a cursive style with a large, sweeping initial 'J'.

John D. Broadwater

*Bruce,
Do you have
Spectrum?*

June 30, 1977

Mr. John D. Broadwater
7901 Chowning Circle
Richmond, Virginia 23229

Dear Mr. Broadwater:

In response to your letter of June 18th to Dr. Rainey, I have enclosed a few color slides for your lecture. I am sorry that the selection is ~~is~~ not better - we tend to hoard the best ones for ~~our~~ own talks.

Suggested reading material is as follows:

The Search For Sybaris 1960-1965 by Froelich G. Rainey and Carlo Lericci with the collaboration of Orville H. Bullitt. 1967

Ditching Techniques for the Archaeologist by Henry N. Michael and Elizabeth K. Ralph. MIT Press, 1971.

In addition, I have enclosed a few reprints and MASCA Newsletters.

We shall appreciate it if you will return the slides.

Sincerely yours,

Elizabeth K. Ralph

Search for Sybaris, Bullitt

June 1st, 1978

Mr. John D. Broadwater
7901 Chowning Circle
Richmond, VA 23229

Dear Mr. Broadwater,

You are welcome to copy the lecture slides that we sent to you on June 30, 1977.

When you return the originals, I can judge better in regard to whether some of them have already been published or whether there is any reason why they should not be used in your publications.

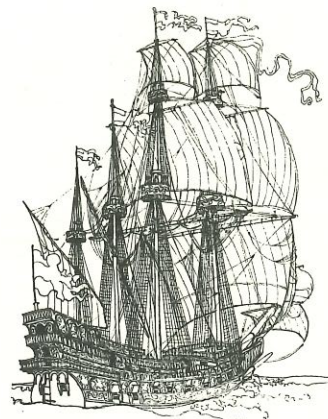
We publish a MASCA Newsletter (copy enclosed) and we welcome short articles (about 700 words) about new projects.

Sincerely yours,

Elizabeth K. Ralph

May 9, 1978

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



John D. Broadwater

Dear Ms. Ralph:

In reference to your letter of June 30, 1977, let me appologize for not returning your slides sooner. The lecture I was to give was postponed, and in the interim, I misplaced the slides. I have just found them and plan to return them to you.

Before I return them, however, I would like to ask permission to reproduce several of them for use in general lectures on science and archaeology. I would not use them for publication without writing for permission and giving proper credit.

Please let me know if you will permit me to make copies. In any case, as soon as I receive your answer, I will return the slides promptly.

I appreciate the helpful information you sent me and I am interested in the work of MASCA. I begin work in about a week as Virginia's first Nautical Archaeologist and I want to use my engineering background as much as possible in utilizing science and technology in the field of archaeology. We have already completed a very successful survey of the York River using a magnetometer, and we anticipate additional work of this type in the future.

Thank you again for your interest and help.

Sincerely,


John D. Broadwater



7901 Chowning Circle
Richmond, VA 23229
(804) 747-0741

March 9, 1961

Dr. Wallace Broecker
Lamont Geological Observatory
Torrey Cliff
Palisades, N.Y.

Dear Wally:

Many thanks for including me in the get-together on January 23rd. It was very helpful to talk things over in a small group.

May I trouble you for the address of Dr. Ostlund in Miami? The company that hopes that geiger anti-coincidence rings can be replaced with plastic scintillators is anxious to ask him about his experience with the latter. We have ordered an 8-liter quartz counter from them (Nuclear-Ohio, Bay Village, O.), but have to have our rooms sealed, air isolated, etc. against tritium contamination before we can try it out.

I have enclosed a reprint of our Maya dating project, but apologize for the excessive data. We should have condensed them if only to prevent them from being scrambled by the editor.

With best regards,
Beth

Beth Ralph

THE BURTON BROWNE CO.



July 22, 1970

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

Dear Miss Ralph:

Your letter of July 15th is sincerely appreciated.
But, quite to the contrary, I do not consider it to
be negative.

I can appreciate that your equipment must be put
to the most fruitful use.

It is most helpful to have the sources you have
given, and we shall investigate them.

Thank you for your prompt and thoughtful res-
ponse to my questions.

Cordially,

Burton Browne

BB-fs

COUNCIL FOR OLD WORLD ARCHAEOLOGY

11 DIVINITY AVENUE

CAMBRIDGE 38, MASSACHUSETTS, U.S.A.

DONALD FREEMAN BROWN

Editor-in-Chief

October 10, 1962

Dear Beth,

At the Congress in Rome I finally met Aitken and was able to "intervene" with a brief talk on the use of the drill in his session on the use of the proton magnetometer. We had many meals and conversations together, and I found him just as fine a person as you had thought him to be. On my way home I wasn't in England long enough to visit Oxford, however.

I am still struggling with a revision of the Sybaris report for "Expedition", but it should be done soon. As some of Delmege's black and white shots are inadequate (fuzzy shots of ~~the~~ your instruments, or no shots at all of the drill in process of boring), I wonder if it would be possible to make black and white enlargements of some of your Kodachromes for the "Expedition" article. I need at least one good shot of the drill, tripod, and motor (selected from Roll 4, nos. 22-24), one of the Jeep drill (28-31), and one or more of the proton magnetometer and resistivity apparatus.

I also need to borrow or have a copy made of the same for a lecture I am giving here on Nov. 16 and possibly at the meeting of the Archaeological Institute in December.

Can you have this done at the University Museum, or would you prefer to send them to me and I will have copies made somehow (we do not have a photo ~~lab~~ at our museum)? I would, of course, pay for this work.

Thanks very much for the C-14 forms which you sent me. I have looked over my neolithic material from Favella, plain of Sybaris. There isn't enough carbonized material for a sample, but I have a good quantity of animal bone which could be used, I suppose, after it has been identified. This is an early Neolithic site and a date of some sort would be extremely important. I do not wish to presume on our friendship, if this is something that you would normally reject, however.

Just out of curiosity, did you have a chance to see how they got samples with the Jeep drill? Studying material that comes up as you bore with a jet of water and a bit can be very tricky as far as stratigraphy is concerned. Apparently you catch the material in a sieve as it comes up, as we did at Gordion, but you are never certain of the exact depth of the material. I wonder how successful it was.

Is Delmege peddling his vino di Cassano in England? And where is Sig. Dollari?

Kindest regards,



Donald F. Brown

October 17, 1962

Dr. Donald F. Brown
Council for Old World Archaeology
11 Divinity Avenue
Cambridge 38, Mass.

Dear Don:

Was glad to hear that you and Martin Aitken had some fun in Rome. Wish I could have been there too.

I have enclosed some Delinege black and white photographs. If these are the ones which you have already rejected, let me know, and I'll get some made from my colored slides.

I'll do something about sending you copies of colored slides in a day or two. They are all mixed up at the moment because Fro borrowed mine and Ellen's for a lecture, as usual, a last-minute emergency. Jim's were not only bad, but he sent Fro poor copies instead of the originals. I suspect that this mistake may have been one too many.

The small photo enclosed illustrates the method of collecting samples from the Jeep drill. It was not quite so bad as it looks because during the last month, Franco and Marjolein de Vos stuck with it the whole time and developed quite a good system. A worker would scoop shovelfuls out in rapid succession as the drill went down. Franco would sort out the sherds from the mud, and Marjolein would record the depths, types of sherds, etc., and put collections immediately into labelled envelopes.

While Jim supervised the Jeep drill for a couple of weeks immediately after you left, all collections were lost and records useless.

Dr. Donald F. Brown

Page 2
October 17, 1962

Speaking of drills, reminds me that we spent yesterday beside Fro's pond trying to make the "Moon" drill work with water. Its operation is similar to that of the Jeep drill, and all that seems to be wrong with it is that the water pump doesn't function properly. When we get that fixed, we have hopes that it will be useful at a few nearby sites where we plan to test instruments later this year.

In regard to the C-14 samples, I am a little doubtful about your animal bones. Unless bones have been charred thoroughly, the carbon in them is subject to exchange with ground waters, etc. We have had discrepancies of 500 years or more between uncharred (or lightly charred) bones and contemporaneous charcoal samples.

Don't know what Delinege is up to nor Sig. Dollani - they seem to be allergic to the Museum.

With best regards,

Elizabeth K. Ralph

EKR:pc

COUNCIL FOR OLD WORLD ARCHAEOLOGY

11 DIVINITY AVENUE

CAMBRIDGE 38, MASSACHUSETTS, U.S.A.

DONALD FREEMAN BROWN

Editor-in-Chief

November 8, 1962

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

Dear Beth,

I was greatly disappointed not to have been able to see you on your trip to Cambridge on October 31. Our baby was in the hospital recovering from a serious operation two days before (prospects look better now, as the malignant cells are apparently not very resistant to X-ray treatment), and two of the older children were throwing up at home as a result of a minor virus, so all in all I decided I was needed more at home than here. You must have enjoyed talking with Prof. Edgerton, who is a very friendly and stimulating person.

Thanks for the enlargements of Delmege's photos, which I did not have. I guess they will do for the Expedition article, or better ones can be substituted when the time comes. But what I need at the moment is 35 mm Kodachromes for a lecture on November 16, and later at the Archaeological Institute meeting late in December. Have you had a chance to get any copies made of the tripod drill, the Jeep drill and the geophysical apparatus? If not, could I borrow just one Kodachrome shot each of these for the lecture next week, for which it would be desirable, but not imperative to illustrate the equipment.

Greetings,

Don

Donald F. Brown

COUNCIL FOR OLD WORLD ARCHAEOLOGY

11 DIVINITY AVENUE

CAMBRIDGE 38, MASSACHUSETTS, U.S.A.

✓
DONALD FREEMAN BROWN

Editor-in-Chief

November 30, 1962

Dear Beth,

send CIA date

You were very kind to send me so many Kodachromes. The first batch arrived just in time for an informal talk I gave at a meeting of a church group, of all things. The talk was sort of a warm up for my paper at the meeting of the Archaeological Institute of America, and I found out which slides were worth showing. The second batch, including seven duplicates, are just what I need to illustrate the drilling. Wasn't it ironical that of all my shots, I did not have a single one of the drilling. What do I owe you for the duplicates?

The article for Expedition was just about finished when I received a huge map and the detailed reports from Lerici. From your article in Italian I got all the information needed about the geophysical work at Sybaris and about the boring which took place after I left. But it did take some time to digest all this, hence the Expedition article was delayed. However, I have it ready for typing and should send it off on the week end. It should be read by you to check any errors in the section on the geophysical instruments, and I shall not object if you find it necessary to rewrite it. My aim was to be as non-technical as possible, yet to explain the use of these instruments and the results of the experiments with them. Please check my translation of "revelatore di fossati" which I called "ditch locator". I do not know what this gadget is, hence my translation may be quite wrong.

Why Roman all the way down, unless the Roman sherds were falling down and following the bit?

The jeep drill stratigraphy leaves me with many doubts. After reading the reports I noticed that frequently, indeed very frequently, the Roman, Greek and archaic levels were identical in span of depth, e.g., Roman 4.50 to 6.50, Greek 4.50 to 6.50, archaic 5.50 to 6.50. Now this could happen in a zone where the material had been violently disturbed by river action or intensive building activity in antiquity (less likely). But to find it repeatedly makes me feel that the wash boring technique of the Jeep drill tends to mix up the stratigraphy. I suspect that the Jeep drill tells only that the archaic material is there, but does not really give any stratigraphy. Making inferences from stuff that comes out of a hole is just as dangerous as making inferences directly from the raw data of your instruments.

Alyson is home after 3 weeks in Children's Hospital. Coming along fine, but being checked regularly for possible recurrence of malignant cell growth. Fingers crossed, pocketbook flat.

Poco tempo, anche io.

Don

Robert Brown



Rensselaer Polytechnic Institute

TROY, NEW YORK

SCHOOL OF SCIENCE
Department of Chemistry
Walker Laboratory

January 18, 1961

Dear Beth,

As you can see, I've finally discovered where the chem department keeps its stationery. Next week is the week for final exams and so this week is the week for studying. Actually there is enough time to study since there are no freshmen chem labs this week. Thus the graduate assistants get a break for a change.

Since I may not get home in between semesters, I thought that I'd better let you know how things stand at the present time. Chances are better than 50-50 that I will start research next semester. From several talks that I've had with my adviser, it seems that to work through the summer would be the most advantageous thing to do as far as the research contract and my progress is concerned. This is especially true since the other graduate student who is going to be working on this project is planning to work here this summer even if we do not start next semester. Therefore, I guess that it would be best for you to start considering some other people for this coming summer for the C^{14} laboratory. Things should be settled here

concerning the summer before February 15th. Of course I'll let you know the final decision immediately but until then I can not make any sort of definite statement.

Before I forget - should I have received a pay check by now or did the holidays confuse things in the comptrollers office again.

I have thought about your contamination problem but I still can not think of any change or anything at all which might be causing it. I guess that you're still as busy as you were at Christmas trying to find it and eliminate it.

Until I see you again, please extend my best wishes to all my friends at Pennsylvania.

Bob.

ROBERT BROWN

February 21, 1961
Troy, New York

Dear Beth,

My schedule for this semester has worked out just about as expected. Officially I am quarter time teaching and quarter time research. Actually this is probably the best arrangement as far as time consumption is concerned. The teaching load for me is three recitation sections. This of course means that I have had to review chem. 1 for myself. It is a little strange starting in the middle of the year since I don't know definitely what was supposed to have been covered first semester and thus what the freshmen should know.

The research load amounts to twelve and one-half hours per week. This is the time which I should put into balance the compensation that I receive at the end of each ~~month~~ month but as you well know it is quite necessary to put in more time in order to get anything done. Essentially the last two weeks have been spent clearing up the lab and reading. I have a problem however, the more I read, the more confusing things become and the less I know

what I want to do. Dr. Clark will eventually have to set me straight.

Of course, all of this boils down to the fact that I'll be working in Troy this coming summer. As much as I enjoy working with you and Bob, the thesis work must come first.

I hope by now that you are well on the way to freeing BW4 and BW6 of ^3H and ^3He . I must say that I thought of you often as I was scrubbing down my own lab. I'd be interested in hearing what the final plans are.

My final point average for last semester was 3.7 on a 4 basis. Therefore it seems that a Pennsylvania education is of some use since no other entering graduate student had any higher average. The task now is to maintain this record and as the saying goes time will tell.

I expect to be in Philadelphia sometime during the spring vacation and so I'll see you then most likely.

Bob.



ROBERT BROWN

Rensselaer Polytechnic Institute

TROY, NEW YORK

SCHOOL OF SCIENCE
Department of Chemistry
Walker Laboratory

October 25, 1961

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

Dear Beth,

Thank you for forwarding the announcement to me from The University of Texas. At the present time I can not express any interest in such a position. I recently changed both my research adviser and project and am now working in the field of radiation chemistry. Possibly this will remain a continuing interest.

My thesis work will be in general the analysis of the products of irradiated gases and the determination of the reaction kinetics and mechanisms. In order to accomplish this, I will be using nitrogen-15, oxygen-18, and oxides of nitrogen-15 and will be analyzing in part with a Bendix time of flight mass spectrometer. Thus the last two weeks have been spent cleaning stopcocks and becoming familiar with the high vacuum rack which I will be using. Next week I start filling reaction bulbs for irradiation at Brookhaven National Laboratory.

Thanks once again for thinking of me and best wishes to both you and Bob. I hope to be home for a short time during Thanksgiving and Christmas so maybe I'll see you then.

Yours truly,

Bob.

November 7, 1961

Mr. Robert Brown
Department of Chemistry, Walker Laboratory
School of Science
Rensselaer Polytechnic Institute
Troy, New York

Dear Bob:

We're delighted to hear that your work will be in fields perhaps more interesting than your initial speculations. Quite aside from our noble altruism, your mass spectrometer work holds an unbelievable fascination for us.

It seems that there are two mass specs in the University now, one of the Bendix types with which you are already familiar, and one Consolidated. We need C^{12}/C^{13} ratios on a few Cl_4 samples, and feel that they might serve to help broaden your mass spectrometer background. Especially since you may find time heavy on your hands during the Thanksgiving and/or Christmas holidays. Hmm?

We are still trying to wheedle the perverse quartz counter into some operable condition, and the lab is limping along on one counter. Beth is busier than ever, but sends her best regards.

If you have time and inclination to play with the Consolidated mass spectrometer during vacation, that would be fine. But if not, at least stop in and be sociable. It will be good to see you.

Sincerely,

AMERICAN INSTITUTE OF INDIAN STUDIES

Incorporated in Delaware 1961

Executive Office • Box 17, Bennett Hall • University of Pennsylvania • Philadelphia, Pennsylvania 19104

W. NORMAN BROWN, *President*
University of Pennsylvania
Philadelphia, Pennsylvania 19104

RICHARD L. PARK, *Vice-President*
University of Pittsburgh
Pittsburgh, Pennsylvania 15213

December 12, 1966

EDWARD C. DIMOCK, Jr., *Secretary*
University of Chicago
Illinois 60637

DONALD S. MURRAY, *Treasurer*
University of Pennsylvania
Philadelphia, Pennsylvania 19104

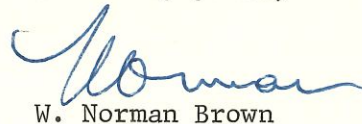
ASCA

Professor George Dales
222 University Museum
Campus

Dear George:

Here is the information about the Proton Magnetometric Survey at Kaveripattinam which I mentioned to you recently. This may be of some interest to the Museum.

Sincerely yours,



W. Norman Brown

WNB:gk1
enclosure

FW
I received this via Norman Brown.
It concerns some proton-magnetometric
surveys in India. They seem to
want to know if we might be interested
in such activities. My reaction is no, but what do you think?
George D.

COPY

DR. S. PARAMASIVAN

6, Rajachar Street
Thyagaroyanagar
Madras-17

Mr. Albert B. Franklin
Consul General
American Embassy
"Agnur"
7 Pycrofts Garden Road
Madras-6

Sir:

PROTON MAGNETOMETRIC SURVEY - KAVERIPATTINAM -
SCIENTIFIC & CULTURAL IMPORTANCE - INDIA AND
FAR EAST.

I have not had the privilege and pleasure of your acquaintance. Nevertheless, I am taking the liberty of writing to you on a subject of great scientific and cultural interest to India and the Far East.

I am sending you a note on the Proton Magnetometric survey of Kaveripattinam, which is an ancient site.

In March last, Prof. E. Thellier, Director of the Institut de Physique du Globe, Paris sent Dr. Yves Martin on an important scientific mission to India at the special request of Prof. F. Filliozat, Director General of the French Institute, Pondicherry. Dr. Martin's work consisted in conducting proton magnetometric survey of ancient sites in the Madras and Pondicherry States.

I have known Profs Thellier and Filliozat for a number of years, both in Paris and in India. I had helped Prof. Thellier in his investigations on the dating of ancient Indian pottery. At my suggestion, the ancient site of Kaveripattinam, which is about 150 miles to the south of Madras and is situated on the coast, was included in Dr. Martin's programme. At their request, I joined the mission headed by Dr. Martin.

As the accompanying note will show, Dr. Martin's results at Kaveripattinam are interesting. After his departure from India, I wrote to the Director General of the Council of Scientific and Industrial Research of the Government of India. In response to my

request, the Director and the Assistant Director of the National Geophysical Research Institute visited Kaveripattinam in my company, and continued the work of Dr. Martin. Their results are even more interesting.

Since the Proton Magnetometer is a delicate electronic device, I also moved the authorities of the Indian Institute of Technology, Madras, through the Government of India, to take up research on Proton Magnetometer. Prof. Meyer (German) and Prof. Sampath (Indian) readily consented to help, and they are now at the job.

There are other sites on the coast, which will yield results of interest to archaeology, art, history and culture of India and of the Far Eastern countries. But these investigations are of vast dimensions and complex. And the progress must necessarily be slow.

It struck me that possibly some of the scientific bodies in the United States might be interested in this scientific venture. The United States have been helping the cause of science in underdeveloped countries. She has the scientific spirit, scientific personnel and resources. The Geophysical Divisions of some of the American Universities and Scientific Institutions might be interested in this subject.

I daresay that any contribution by the United States to the cause of science and culture will supplement and complement the great work which they are doing in Viet Nam in the larger interest of the free countries of Asia.

I may be permitted to assure you that I have no vested interests in approaching you, except to further the interest of American-Indian collaboration as also the American - Far Eastern in the field of culture. As one responsible for the initial investigations of Dr. Martin at Kaveripattinam, their continuance by the National Geophysical Research Institute and for the Indian Institute of Technology taking up research on the electronic side, I am also approaching you. There is the French collaboration from Paris and Pondicherry, German collaboration from the Indian Institute of Technology, Madras. There is also the Indian collaboration. I shall try my best to bring in the Archaeological Survey of India, the Government of India and the Madras State into the scheme. In fact, the Government of India are already there to some extent. But the American collaboration will heighten the value of these investigations. I am eager to continue the investigations with utmost speed and with American scientific thoroughness. If this is possible, I shall place my free services at your disposal and that of the American scientific parties.

I am very sorry for this long letter.

Very sincerely yours,

/s/
S. Paramasivan

COPY

PROTON MAGNETOMETRIC SURVEY OF KAVERIPATTINAM -
AN ANCIENT SITE

By

Dr. S. Paramasivan, M.A., D.Sc.

The Aurobindo Ashram, Pondicherry, had some special assignment, which needed the use of a proton magnetometer. This is an instrument, which will locate buried archaeological materials through the study of the magnetic anomalies in the earth's magnetic field. Prof. E. Thellier, Director of the Institut de Physique du Globe, Paris, and Prof. J. Filliozat, Director General of the French Institute, Pondicherry, were approached by the authorities of the Aurobindo Ashram. In February last, Dr. Yves Martin of the Institut de Physique du Globe, Paris was given this assignment under the joint auspices of the two institutions. He stayed in India for about four weeks.

2. I have known Prof. Thellier and Prof. Filliozat for several years, both in Paris and in India. They sent word to me that, in case I could fix up a programme of archaeological exploration in consultation with the Archaeological Survey of India, the Department of Archaeology, of the Madras University and the Madras State Department of Archaeology, they would be happy to spare the free services of Dr. Martin. This was done. At the request of Profs. Thellier and Filliozat, I accompanied Dr. Martin in the course of this instrumental survey. Woriyur (the capital of the Cholas), Kambarmedu (the birth place of Kambar), Kaveripattinam (the sea port of the Cholas) and Nattamedu (similar to Arikamedu, which was excavated by Sir Mortimer Wheeler) were some of the sites explored by Dr. Martin.

3. The instrumental survey is the first of its kind in India and yielded very interesting results. The instrument gives the value of the earth's magnetic field at various points. From the anomalous values obtained, one may pinpoint the actual spots where excavation would be most fruitful. By the use of this instrument, there will be no hit and miss methods in archaeological exploration and excavation. The actual excavation will become cheap. Archaeological exploration and excavation are based on surface indications, which guide the archaeologists. They may miss a site which has no surface indications or where they have been obliterated by later accretions. In such cases, instruments like the proton magnetometer comes in handy.

4. Of the different sites surveyed by Dr. Martin with his instrument, Kaveripattinam has some special interest. There are accounts of Kaveripattinam in the Western writings of the early Christian era, as also in the ancient Tamil classics. According to the Tamil classics, the city was supposed to have been engulfed by the sea, even as portions of the island of Rameswaram has been within recent years.

5. Experts in Environmental Archaeology have come to the scientific conclusion that there was a rise in the sea level between the 4th century B.C. and 4th century A.D., that is, roughly the period corresponding to the date of destruction of Kaveripattinam. Even otherwise, the floods in the river Kaveri, on which Kaveripattinam was situated, the tides on a full moon or even a tidal wave might have swept away the ancient city.

6. I was, therefore, anxious to have some instrumental archaeological exploration conducted with the proton magnetometer on the beach at Kaveripattinam. I selected a small experimental area on the beach, 20 metres by 20 metres, and about 6 metres from the water's edge. This small square on the beach showed magnetic anomalies in the west-east direction corresponding to the buried archaeological materials in three or four places. They probably extend into the sea. There is no reason for the archaeological materials to be present so near the water's edge, unless it be that the sea itself had invaded what was once land.

7. The French mission was greatly encouraged by these results. They wish to sensitise their instruments not only for land survey, but also for over-water search for under-water archaeological materials. Prof. Thellier has written to me that his Institute would co-operate and help any investigation by Indian scientific and cultural institutions applying geophysics to archaeological exploration. Prof. Filliozat has also assured me of similar help.

8. I was encouraged by the helpful, scientific attitude of Prof. Thellier and Prof. Filliozat. I wrote to the Director General of the Council of Scientific & Industrial Research in the matter. He deputed the Director and the Assistant Director of the National Geophysical Research Institute to continue the work of Dr. Martin at Kaveripattinam. I accompanied them to Kaveripattinam.

9. The Director and the Assistant Director took a rectangular strip, 800 metres long, with the actual water's edge on one side, and 20 metres broad, stretching from a point opposite to the Kannagi statue (a modern construction), covering the mouth of the river, Kaveri and running a little beyond. This area includes a portion of the square investigated by Dr. Martin. While Dr. Martin's square was 6 metres from the water's edge, this rectangle had the water's edge as one of the sides.

10. Of the 800 metres, the first 50 metres have haphazard readings due to the presence of iron materials in the enclosure containing the Kannagi statue, which were in the form of iron pipes, fencing etc. The next 350 metres, which also includes the area investigated by Dr. Martin, present magnetic anomalies indicating the presence of buried archaeological materials. Thus the anomalies are not peculiar to Dr. Martin's area. They seem to be universal in this area.

11. The next 400 metres, which also covers the mouth of the river Kaveri, show no magnetic anomalies. It may mean that the river Kaveri was much wider in ancient times than it is today. This would preclude the presence of ancient settlements in this region or of ancient materials.

12. There is, therefore, the problem of extending the work over the land as also over the sea.

13. There is another aspect to the whole question. Several ship wrecks, which had occurred in the almost landlocked Mediterranean, have been recovered by Jacques Ives Cousteau and their contents "archaeologically excavated". Several ship wrecks of the early times, and especially of the Kaveripattinam period, might have occurred in the more open Bay of Bengal, the "archaeological excavation" of which might lead to the reconstruction of ancient history and culture, not only of India (and Kaveripattinam, in particular), but also of the Far Eastern countries encircling the Bay of Bengal. In addition, Kaveripattinam had trade and commerce with the Mediterranean countries. One might get a great deal of information about them for a study of these ship wrecks. The Institute de Physique du Globe, Paris and the French Institute, Pondicherry, are naturally interested in these investigations. Apart from these studies, the proton magnetometric studies might help us to fix the location of Kaveripattinam and its environs.

/s/

S. Paramasivan

tel. 793-1350

Suggested he study shell fragments
12/14/71

WILLIAM M. D. BRYANT

~~MARSHALTON ROAD, P. O. BOX 65~~ N. Wawaset Road
WEST CHESTER, PENNSYLVANIA
19380

November 29, 1971

Miss Elizabeth K. Ralph, Associate Director
Applied Science Center for Archaeology
The University Museum
33rd and Spruce Streets
Philadelphia, Pa. 19104

Comparative sherds
rocks
Dr. Pritchard will bring next time

Dear Miss Ralph:

Last spring Dr. Pritchard handed me an envelope containing fourteen sawn pottery sections from Sarepta (II X A Room 1 (24) 513-526), evidently from the lowest bronze age level. I agreed to examine the specimens by petrographic microscopy and related techniques, with special emphasis on constituents that might suggest the regional origin of the pottery.

Since preparation of thin sections of pottery is a specialized technique, more difficult than sectioning ordinary rock specimens, I was advised to consult Dr. Frederick Matson at Pennsylvania State University. He very kindly explained the methods of sectioning ceramic materials, but highly recommended low power direct examination of the sawn sections, since it was felt that thin sections should be limited to specimens of particular interest because of the time-consuming nature of the methods. His experimental firings of variously treated clays were most revealing and helpful in a general way in interpreting the appearance of the sherds from Sarepta.

With this advance preparation, I examined all fourteen specimens as received, first at 5X under the stereoscopic microscope, then at 30X under an ore microscope using reflected polarized light (crossed polars). The polarized light here functioned mainly to remove glare and provide a uniform shadowless illumination, as magnification was too low to permit study of the polarizing properties of individual mineral grains. It was possible in this way to observe the presence and size range of quartz particles, the cavities filled with white powder resulting from the calcining of limestone or shell fragments. There were also cavities evidently resulting from the charring of organic constituents (twigs, grass stubble, etc.). The fineness of the clay texture could be observed, and the characteristic colors of various layers bore some relationship to the firing conditions (oxidizing vs. reducing atmosphere), and volatilization of mineral components. There was a fair amount of variation of these properties through the series of sherds.

One specimen, No. 520, of moderate fineness, was singled out for thin sectioning. The specimen was impregnated at room temperature, in a vacuum, with Buehler's AB epoxy resin. The resulting block was sawn (diamond saw) into three parallel slices a millimeter or so in thickness and cemented with Lakeside cement (canada balsam type) to three slides preground to specified thickness. The specimens were then ground with No.600 grit silicon carbide at about 200 rpm on a cast iron lap (water as lubricant), using a Buehler clamping holder to reduce the sections to about 50 microns thickness. They were then hand ground to 15-25 microns. Cover glasses were attached with canada balsam.

WILLIAM M. D. BRYANT

~~MUSEUM OF ART AND HISTORY~~
WEST CHESTER, PENNSYLVANIA

All three specimens are usable, although not works of art, since this represented a first attempt at grinding a porous specimen impregnated with resin. Some material was lost by over-grinding.

Examination of the thin sections from No. 520 in transmitted light between crossed polars at 170X showed about 20% of sharp fragments of quartz, averaging about 200 microns in diameter and perhaps another 20% of similarly sized or larger aggregates of fine calcite crystals. Among the large quartz fragments were a few comparable fragments of feldspar (banded twinning), reddish brown blobs of goethite or a less crystalline precursor, possible amphibole and a large flake judged to be an oversize kaolinite crystal, possibly rehydrated or not broken down by firing. Using oil immersion and a high aperture lens system it was possible to obtain interference figures confirming quartz and calcite. A negative biaxial mineral had an optic axial angle, $2H$, of about 61° ($2V$ about 55°). This could be oversize kaolinite, the balance of which would be much too fine to characterize optically. Regarding conclusions based on foreign mineral constituents in the clay, more specimens would need to be sectioned and literature on the local mineralization consulted. It could be said from the study of one thin section that the pottery was evidently made near a sea coast where contemporary or fossil shell could not be avoided. Large percentages of calcium are said to be undesirable in pottery clays, since this would favor fluxing and hence a narrow temperature range for firing. The quartz is a desirable bodying agent, especially for large vessels.

Quite inadvertently I became aware of a very powerful technique for detection and measurement of atomic species present in pottery. Without knowing of my interest in characterizing ancient pottery, a Du Pont friend of mine, Victor Hanson, now scientific coordinator at Winterthur Museum, invited me to see some new X-ray fluorescence equipment he has been using to determine the elements present in antique pottery and coinage. Although X-ray fluorescence is an old technique, recent extensive improvements in instrumentation have greatly increased its scope and ease of application to such materials as ceramics. The equipment embodies a new more sensitive detection system and the use of radioactive X-ray sources that can be brought very close to the specimen, thus reducing time of measurement. It measures the energy level and intensity of the K and L series X-ray spectra of the elements present in the specimen and is thus independent of diffracted X-rays used to characterize chemical compounds by their crystal structure. Mr. Hanson very kindly asked me to bring some of the Phoenician pottery to test. I accepted this opportunity and we tried two Sarepta sherds, Nos. 517 and 519. Using 241 americium and 109 cadmium X-ray sources in quantitative fashion and 55 iron qualitatively, some rather interesting information was obtained. In less than two hours analyses for twelve elements in each sample were in hand. It was an advantage to have sawn surfaces to work with, since Mr. Hanson has to abrade a patch on the underside of colonial plates in order to avoid the lead glaze which is highly absorbent of X-rays. With proper calibrations and familiarity with the X-ray energy spectrum it is possible to obtain quite acceptable quantitative results. Using a table of energies and characteristic intensities for very pure elements and their compounds prepared by Mr. Hanson, I was able to calculate rough weight percentages of the elements observed and have included them in a

WILLIAM M. D. BRYANT

~~MARSHALTON ROAD, R. D. 4
WEST CHESTER, PENNSYLVANIA~~

table, comparing the two sherds examined. Under the conditions used, elements lighter than silicon are not readily measured. The alkaline earth elements are calculated as carbonates and all other metals as oxides. Bromine and iodine are calculated as elements for lack of knowledge of their true associations. The elements measured are present to the same order of magnitude in both sherds, suggesting that they are both from the same clay source, perhaps modified by firing conditions and shell content. An interesting feature is the finding of more than a percent of rare earth oxides of the cerium group in both sherds. Small amounts of rubidium and zirconium are detected, and somewhat more barium and strontium than might have been expected. The elements were taken more or less as they appeared in the spectra. By expenditure of more time, and using digital rather than analog recording (Winterthur has both) it would, no doubt, have been possible to bring in other elements at lower levels. I believe X-ray energy spectra would provide a practical means of tracing the geographical origin of pottery and other inorganic trade goods of ancient times. The volume output could be much greater than by the more time-consuming petrographic techniques which are more useful in detecting specific compounds where this information is needed.

I have a collection of work sheets with descriptions derived from low power (5X and 30X) inspection of all fourteen sherds. It is possible that on this basis other sherds could be selected for thin sectioning. Polacolor positives of the first four sherds, made at 30X under the Vickers ore microscope were handed to Dr. Pritchard on an earlier occasion.

This study has been an interesting one for me, even though it was realized at the start that the clay minerals from which pottery is made, occur in particle sizes below those most conveniently studied by polarized light microscopy. For that reason interest was concentrated on larger mineral particles present as contaminants. The X-ray fluorescence results far outshone those obtained by microscopy as possible means of identifying sources of inorganic raw materials.

Sincerely,


W.M.D. Bryant

WILLIAM M. D. BRYANT

~~MARSHALL ROAD, P. O. BOX 4~~
WEST CHESTER, PENNSYLVANIA

Table I

Composition by Weight Calculated from X-ray
Energy Spectra

<u>Constituent</u>	<u>No. 517</u>	<u>NO. 519</u>
CaCO ₃	24.7	37.7
Fe ₂ O ₃	3.0	2.3
Rb ₂ O	0.04	0.03
SrCO ₃	0.39	0.42
BaCO ₃	0.76	0.76
La ₂ O ₃	0.09	0.12
Ce ₂ O ₃	0.38	0.30
Pr ₂ O ₃	0.12	0.09
Nd ₂ O ₃	0.56	0.91
ZrO ₂	0.12	0.10
I ₂	0.07	0.06
Br ₂	0.06	0.05
Al ₂ O ₃ (by diff.)*	20.77	17.03
SiO ₂ (by diff.)**	48.94	40.13
	100.00	100.00

* Part of the Al₂O₃ may be replaced by MgO** Half of SiO₂ assumed to be quartz sand

Total	1.15	1.42
rare earths as oxides		

3/19/70

Dear Miss Ralph,

Thank you very much for your kindness in showing me around the Applied Science Center when I was there last month. I enjoyed myself and learned quite a lot.

When I was there, I showed you a patent description for a dynamic profiling system, which you expressed interest in. Please find enclosed a copy of that patent. If I can be of any further assistance, please let me know.

Thank you again.

yours,

Alan Baber, Jr.

435 Elm

New Haven

Conn. 06511

Jan. 31, 1967

B. M. CARDER

3,301,345

SEISMIC SURVEY SYSTEM

Filed Feb. 8, 1965

4 Sheets-Sheet 1

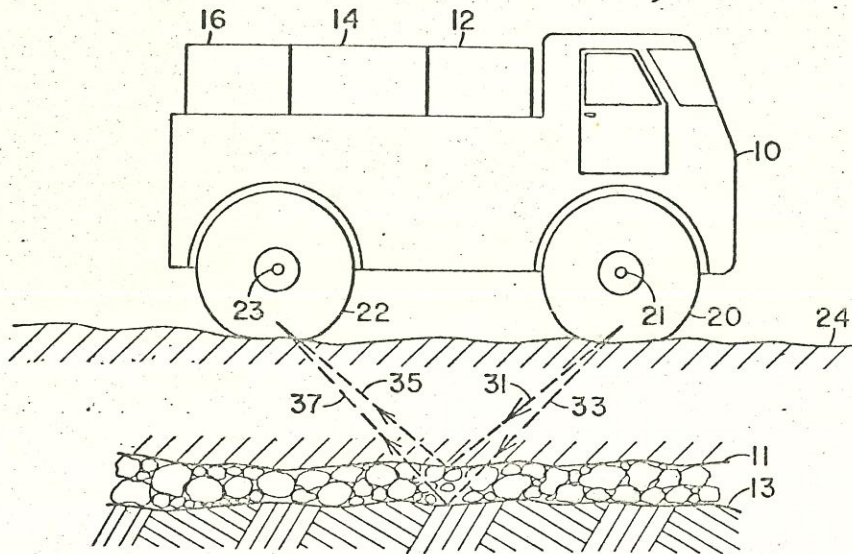


Fig. 1

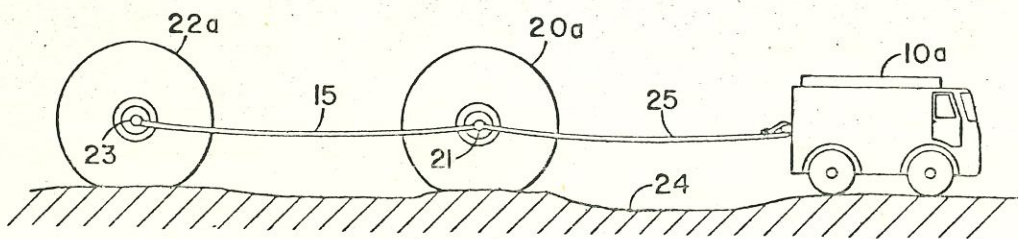


Fig. 2

BRUCE M. CARDER
INVENTOR.

BY *Cadwalder, Kelly &*
Dacey
ATTORNEYS

Jan. 31, 1967

B. M. CARDER

3,301,345

SEISMIC SURVEY SYSTEM

Filed Feb. 8, 1965

4 Sheets-Sheet 2

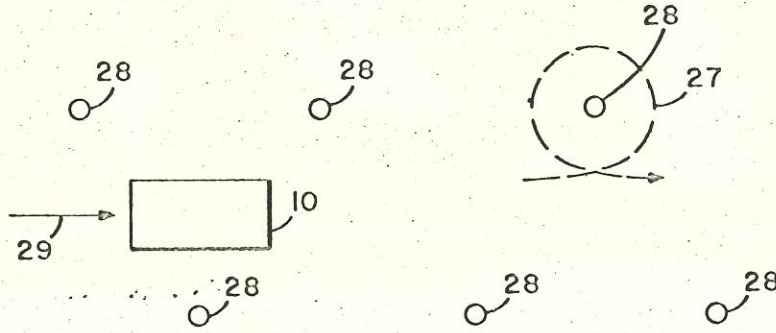


Fig. 3

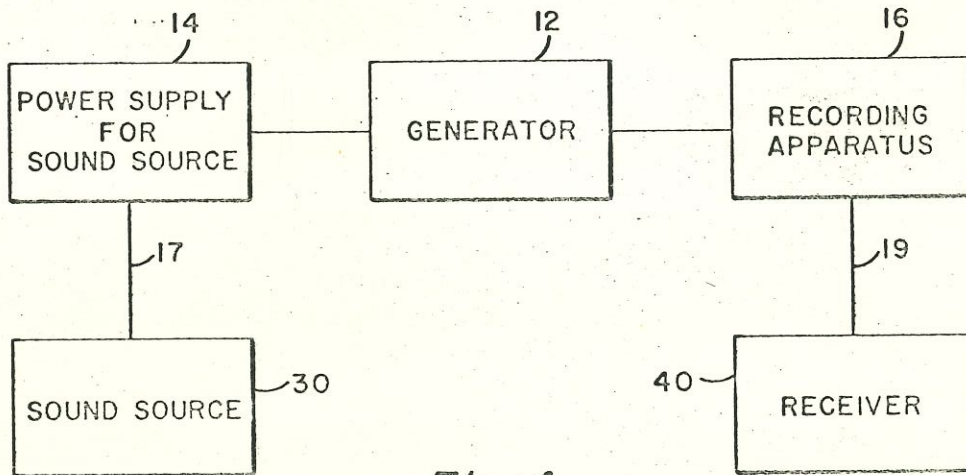


Fig. 4

BRUCE M. CARDER
INVENTOR.

BY *Cabrallado, Kelly & Dancy*
ATTORNEYS

Jan. 31, 1967

B. M. CARDER
SEISMIC SURVEY SYSTEM

3,301,345

Filed Feb. 8, 1965

4 Sheets-Sheet 3

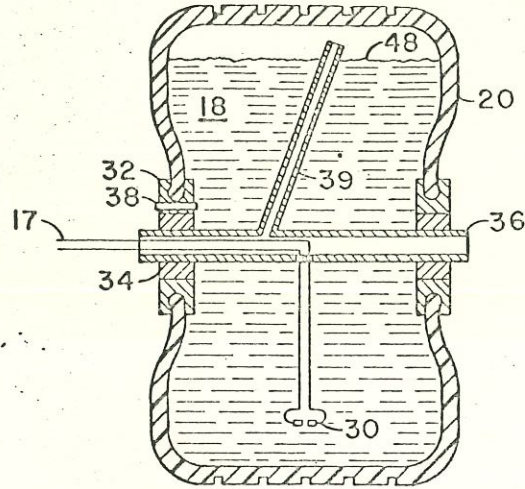


Fig. 5

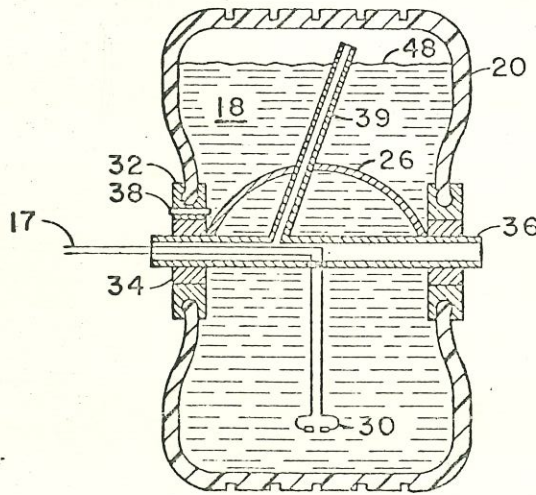


Fig. 6

BRUCE M. CARDER
INVENTOR

BY *Cadwell, Kelly & Dwyer*

ATTORNEYS

Jan. 31, 1967

B. M. CARDER

3,301,345

SEISMIC SURVEY SYSTEM

Filed Feb. 8, 1965

4 Sheets-Sheet 4

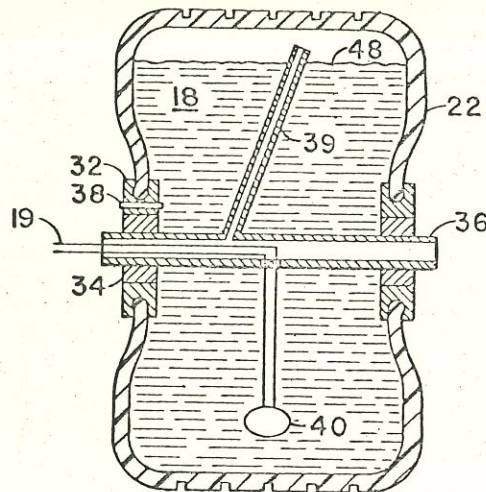


Fig. 7

BRUCE M. CARDER
INVENTOR

BY *Cashellides, Kelly &*
Dacey
ATTORNEYS

1

3,301,345
SEISMIC SURVEY SYSTEM

Bruce M. Carder, Las Vegas, Nev., assignor to Edgerton, Germeshausen & Grier, Inc., Bedford, Mass., a corporation of Massachusetts

Filed Feb. 8, 1965, Ser. No. 430,858

5 Claims. (Cl. 181--5)

The present invention relates generally to seismic survey systems and, more particularly, to apparatus for obtaining seismic profiles of the contours of strata of interest lying below the surface of the earth. The present invention permits the adaptation and use of conventional marine seismic profiling systems directly to land use in a novel manner.

Heretofore, sound impulses used for seismic profiling over land have been coupled into the ground by using a sound source mounted within a liquid filled tank provided with a rubber diaphragm separating the liquid from the surface of the earth. Systems such as these are cumbersome in that the entire equipment, including the liquid filled tank, will have to be either emptied or lifted as such and moved from location to location, making for difficult, time consuming and expensive operation whose expenses mount with increasing distances to be surveyed. (One such system has recently been described in the August 17, 1964, issue of *The Oil and Gas Journal*, pp. 68-69, "New Seismic Tool Uses Electrical 'Pop.'")

Seismic profiling systems operating over water have been more efficient since both the sound source and the receiver are normally mounted on a floating support, such as a ship, that is continuously being propelled over the course desired to be charted. The ship also carries all necessary power systems as well as supporting equipment required to obtain continuous survey records. Furthermore, such survey records are almost immediately available for analysis by qualified personnel aboard the ship. The present invention adapts some of these known water surveying means to land use.

It is, therefore, an object of the present invention to provide a continuous seismic profiling system and method for obtaining records of the contours of strata lying below the surface of the earth while the system of the invention is being continuously moved along the surface of the earth at a predetermined speed. It is another object of the present invention to provide a continuous seismic profiling system and method that will permit the obtaining of continuous records without the necessity for physically lifting a liquid filled tank in between transmissions of sound impulses. It is a further object of the present invention to provide a continuous seismic surveying system and method which is characterized by improved performance at much reduced cost.

Other and further objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the improved continuous seismic surveying system and method possessing the construction, combination of elements, and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of which will be indicated in the appended claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description, taken in connection with accompanying drawings wherein:

FIGURE 1 is a side elevational view of a self-contained and self-propelled seismic profiling system for use over land, showing also a portion of the crust of the earth, in vertical section, with representative substrata whose contours are intended to be reproduced on a chart;

FIGURE 2 depicts a modification in the continuous

2

seismic profiling system of the invention in which the sound source and the receiving element are separated from the vehicular means moving them along the surface of the earth;

FIGURE 3 is a schematic view of a further method of obtaining continuous seismic profiling records in accordance with the teachings of the invention;

FIGURE 4 is a block diagram of a seismic profiling system according to the invention;

FIGURE 5 is a vertical section along the axis of a hollow rotatable member, such as an oversize tire, filled with a liquid medium, and shown mounted therein a source, such as a spark gap, for generating sound impulses;

FIGURE 6 is a view similar to that shown in FIGURE 5, but also showing a reflector means mounted within the hollow rotatable member; and

FIGURE 7 is a view also similar to FIGURE 5, but showing a receiver means, such as a hydrophone element, for receiving reflected sound impulses from substrata of interest.

In general, the continuous seismic profiling system comprises: a means for generating sound impulses mounted in a liquid medium contained within a first hollow rotatable member as the member is continuously being moved along the surface of the earth; a means for receiving reflected sound impulses which may also be mounted in a liquid medium contained in a second hollow rotatable member; or which may be stationarily positioned on the surface of the earth; power supply means for operating the system; and means for converting the received reflected sound impulses into a continuous survey record.

Referring to the drawings in which like reference characters refer to like parts throughout and in particular to FIGURE 1, there is shown a self-contained and self-propelled seismic profiling system for use over land and constructed in accordance with and embodying the present invention. The seismic profiling system of FIGURE 1 essentially comprises a vehicular means 10 designed to accommodate therein all of the required operative parts of the system and also carrying the personnel necessary to operate the system. The system employs a power supply, such as a generator 12, which may be a conventional diesel electric generator or a battery or any other means designed to supply electrical energy for the operation of the system. Generator 12 basically supplies power for a power supply 14 intended for driving a sound generating source. This power supply 14 may comprise, for example, a capacitor bank together with its associated circuitry, and is connected to a sound generating source, as will be more apparent herein below.

Generator 12 also supplies the necessary power for driving a suitable recording apparatus 16, which may be any conventional recording apparatus used in marine seismic profiling on board ships for preparing continuous survey charts. The input signals to the recording apparatus 16 are transmitted thereto from a receiver, as will be more apparent from the following disclosure. The vehicular means 10 is preferably constructed substantially as shown in FIGURE 1. It may be constructed, however, if so desired to contain only the sound source, receiver, power supply and recording unit, while having the necessary locomotion imparted thereto by independent means. The vehicular means 10 is preferably designed and constructed to move over any sort of terrain normally found in areas to be surveyed whether it be flat land, or hilly and rocky country, or marsh land. The vehicular means 10 is made to travel on rotatable members 20 and 22 that represent respectively, the front and rear tires of the vehicle. These rotatable members 20 and 22 are specially designed, oversized tires that are filled with a liquid medium, such as salt water, oil or any

other non-compressible fluid and are also intended for containing the sound source and receiver means, respectively.

Thus, rotatable members 20 and 22 perform, in fact, two functions; that of imparting locomotion to the vehicle 10 and that of serving as containers for the sound source and receiver means of the seismic surveying system of the invention.

The vehicle 10 may have only two of these tires or members 20 and 22, one in front and one in the rear, or it may be designed as a conventional four-wheeled vehicle with two of these special tires mounted in front and two in the rear. These hollow rotatable members or tires 20 and 22 are designed for rotation about their respective axles 21 and 23, on which the frame or chassis of the vehicle 10 is mounted. Either or both of these front and rear members 20 and 22 may be designed for providing the driving force of motion to the vehicle 10. The necessary rotary motion may be imparted to the members 20 and 22 in any conventional known manner, keeping in mind the particular respective use of the vehicle 10 with regard to the terrain to be surveyed, such as steepness of the slopes and the composition of the surface of the earth.

One of these hollow rotatable members is intended to contain the sound source for generating sound impulses in the liquid medium contained within the member and for coupling the generated sound impulses into the ground 24 by the rubber surface of the tire 20, serving as a continuously rotating diaphragm as the vehicular means 10 moves along the surface of the earth. As may be noted in FIGURE 1, these generated sound impulse waves, shown in the drawing by lines 31 and 33, penetrate into the ground 24 until they strike the particular substrata of interest 11 and 13 from which they are reflected as shown by lines 35 and 37 to a receiver means located in the other rotatable member 22. Electrical signals generated by the receiver means responsive to these reflected pulses 35 and 37 are then transmitted from the receiver to the recording apparatus 16, which then produces a continuous seismic survey record of the substrata of the earth as the vehicle 10 is moving along the surface of the earth. The survey record obtained is highly accurate and, since it is readily available simultaneously with the run being made, it may be interpreted at the time the site is being charted. In FIGURE 2 is shown two rotatable members 20a and 22a carrying the sound source and receiver and being pulled in a detachable manner by a vehicle 10a. It must be pointed out that while only one receiver means is shown as being utilized in FIGURES 1 and 2, as many receiver means may be used in the system of the invention as may be desired, provided always that for each such additional receiver means an additional hollow rotatable member is utilized. Such additional hollow rotatable members may be conveniently towed behind the members 22 or 22a, as the case may be, by suitable connecting means (not shown).

The two rotatable members 20a and 22a are positioned in spaced apart relationship to one another, which distance is continuously being maintained in a convenient manner, such as by a connecting rod 15 while the system is being towed by a vehicle 10a. The vehicle 10a, in turn, may be detachably coupled to the rotatable members 20a and 22a by a cable 25. The electrical connections to the sound source and receiver means respectively contained within rotatable members 20a and 22a, are of course carried by these connecting means 15 and 25 to the power supply and recording apparatus mounted on the vehicle 10a.

FIGURE 3 depicts, in a schematic way, a further method of obtaining continuous seismic survey records in which a self-contained and self-propelled vehicle 10 may be moved in between two rows of seismic receivers 28 as shown by the direction of the arrow 29. These seismic receivers 28 may be geophones selectively positioned over the surfaces to be charted.

In this method, sound impulses are generated and coupled into the ground from the vehicle 10 in like manner as shown and described with reference to FIGURE 1. The reflected waves, however, are not received in the moving vehicle 10, but instead are received by these respective geophones 28. The vehicle 10 may move in between these rows of geophones 28 as shown by the arrow 29 or for certain specialized applications, the vehicle 10 may be moved in circular motions about one or more of these geophones 28, as shown by the dashed arrow 27.

FIGURE 4 depicts in a block diagram the component parts and their relationship of a seismic surveying system constructed in accordance with the invention.

FIGURES 5, 6, and 7 are similar in that they show, in verticle section along the axis, a hollow rotatable member constructed in accordance with and embodying the present invention. FIGURES 5 and 6 show two aspects of the construction of a sound source 30 mounted within a rotatable member, while FIGURE 7 shows the disposition therein of a receiver means 40, such as a hydrophone.

With particular reference to FIGURE 5, it may be noted that the hollow rotatable member 20 is essentially an oversized, specially built tire made of rubber and having a rather large, flat peripheral surface that comes in contact with the ground. In relation to its size, the walls of the tire are relatively thin, allowing thereby for better coupling of the sound impulses into the ground. It will be appreciated that the continuously rotating peripheral surface of the tire acts as a rubber diaphragm for transferring the generated sound impulses to the ground as the tire is continuously being rolled about its axis 35 along the surface of the ground.

The interior of the hollow rotatable member 20 is filled with a noncompressible fluid 18, which may be salt water or fresh water, oil or any other noncompressible liquid medium depending upon the particular sound source being used for generating sound impulses therein. For example, if the sound source 30 used is a spark gap, as shown in FIGURE 5, the fluid medium may be salt water. Should the sound source 30 be represented by a dome-shaped transducer type of arrangement, such as a metallic plate which is subjected to sudden and violent vibrations, the fluid medium may be fresh water or other noncompressible liquid.

A pair of wires 17 are shown connected to the respective ends of the sound source 30 and are designed for carrying the required electrical energy for sound impulse generation from a suitable power supply 14, which may be mounted on the vehicle 10, as already stated. The power supply 14, may be, for example, a capacitor bank together with its associated circuitry intended for sudden and repeatable discharges of a main discharge capacitor between the electrodes of the sound source 30. The capacitor bank may be discharged in any well known manner as will be appreciated by those skilled in the art, such as by the use of a triggered spark gap or a thyatron switch. It should also be appreciated that the two wires 17 are provided with a suitable insulating material (not shown) and may be conveniently admitted into the interior of the rotatable member 20 through suitable apertures provided in the stationary axle 36.

In accordance with well understood principles of sound impulse transmission, the sound source 30 is preferably positioned in close proximity with the peripheral wall of the member 20, substantially as shown in FIGURE 5. It will also be appreciated by those skilled in the art that any sound impulse generated by the sound source 30, as by the sudden discharge of energy between the electrodes in the form of a spark, will send sound impulses in all directions and those sound impulses that are being sent up through the fluid medium 18 are then going to be reflected by the upper surface 48 of the medium 18, serving as an excellent reflector. If for any reason it may be desirable to use specially shaped and contoured reflectors, the arrangement as shown in FIGURE 6 may be the preferable one. As may be noted in FIGURE 6 an inde-

pendent reflector 26 is also built inside the hollow interior of the rotatable member 20 and is disposed diametrically to the sound source 30 and in spaced apart relation thereto. The reflector 26 may be hard material such as, for example, steel and may be conveniently attached to the stationary axle 36 of the rotatable member 20. It will also be appreciated by those skilled in the art that by properly selecting the shape of the reflector 26 and its disposition with respect to the sound source 30, the resultant sound waves being coupled into the ground may be varied in frequency and wave length in accordance with the requirements of the terrain to be surveyed and as to what depth the sound impulses are to generate into the ground.

As may be noted, the hollow rotatable member 20 is mounted on a suitable rim, such as a tire rim 32, preferably made of metal, which is then secured to a suitable bearing and seal means 34 designed to permit rotation of the member 20 about the stationary axis 36 in such a manner that the fluid medium 18 contained therein is not allowed to leak out. Such bearing and seal means 34 may, for example, be represented by convenient ball-bearing mechanisms having appropriate O seals disposed about the bearing assembly. The salt water, or other fluid medium 18, may be conveniently admitted into the interior of the hollow rotatable member 20 via a filler inlet 38, provided in the rim 32. To permit the escaping of the air from the interior of the member 20 as the same is being filled with the liquid, a suitable breather pipe 39 may be provided, having connection to the atmosphere through the stationary axle 36, subsequently as shown. After the member 20 has been filled with a liquid medium 18, the filler inlet 38 may be conveniently sealed off, as by a cap (not shown). FIGURE 7 shows a receiver 40 which may be a hydrophone designed to receive reflected pulses and generating, responsive thereto, electrical signals which are then fed by the respective wire connections 19 to a recording apparatus 16, mounted on the vehicle 10.

The seismic survey charts or records are, of course, obtained in a manner well known to those skilled in the art and this does not per se form a part of this invention. As may be appreciated from the above disclosure, the present invention provides an improved and highly efficient seismic profiling system for obtaining continuous seismic profiling records over land terrain in much the same manner as done over water. The improved method of obtaining seismic profiling record permits precision mapping of any strata of interest below the surface of the earth in a simple and highly economical manner. Particularly, the present invention eliminates the need for continuous lifting and moving the sound producing source from station to station over the surface intended to be charted.

Since certain changes may be made in the above described seismic survey system and method without departing from the scope herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted in an illustrative and not in a limiting sense.

What is claimed is:

1. A seismic surveying system comprising a means for generating sound impulses mounted in a liquid medium

contained within a first hollow rotatable member; a means for receiving reflected sound impulses mounted in a liquid medium contained within a second hollow rotatable member positioned in spaced apart relationship to said first member; and means for converting said received reflected sound impulses into a survey record.

2. A seismic surveying system comprising a means for generating sound impulses mounted in a liquid medium contained within a first hollow rotatable member; a means for receiving reflected sound impulses mounted in a liquid medium contained within a second hollow rotatable member; said first and second rotatable members defining also the means of motion for a vehicular member mounted thereon; and means mounted on said vehicular member for converting said received reflected sound impulses into a survey record.

3. A seismic surveying system comprising a means for generating sound impulses mounted in a liquid medium contained within a first rotatable member; a means for receiving reflected sound impulses mounted in a liquid medium contained within a second rotatable member; said first and second members positioned in spaced apart relationship relative to one another and being designed for motion along the surface of land; means for imparting said motion to said members; and means for converting said received reflected sound impulses into a survey record.

4. A seismic surveying system comprising a means for generating sound impulses mounted in a liquid medium contained within a first hollow rotatable member; reflector means mounted within said member and at a distance from said means for generating sound impulses; means for receiving reflected sound impulses mounted in a liquid medium contained with a second hollow rotatable member; said members positioned in spaced apart relationship relative to one another and being provided with means of locomotion to travel along the surface of the earth; and means for converting said received reflected sound impulses into a survey record.

5. A seismic surveying system comprising a sound source disposed in a liquid medium contained within a first hollow rotatable member; a transducer mounted in a liquid medium contained within a second hollow rotatable member; said members being positioned in spaced apart relationship relative to one another and being provided with means to impart rotary motion thereto; means for supplying power for said sound source for generating sound impulses; and means including circuit means for converting received sound impulses into a survey record.

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3,105,424	10/1963	Dion et al.	94—50
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BENJAMIN A. BORCHELT, *Primary Examiner.*

60 SAMUEL FEINBERG, *Examiner.*

G. H. GLANZMAN, *Assistant Examiner.*

NORTHWESTERN UNIVERSITY

EVANSTON, ILLINOIS 60201

DEPARTMENT OF ANTHROPOLOGY

December 2, 1970

Dr. Elizabeth Ralph
Applied Science Center for Archeology
University of Pennsylvania
Philadelphia, Pennsylvania 19104

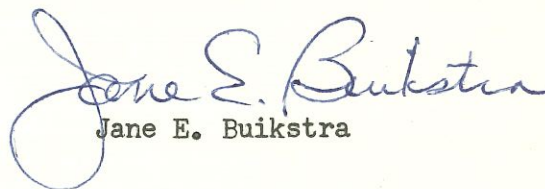
Dear Dr. Ralph:

Due to the recent closing of the Radiocarbon lab at the University of Michigan, I have been stranded with three C-14 samples, very little money, and a plethora of conflicting opinions concerning the best possible alternative to Michigan. I recently discussed this problem with Stuart Struever, and he suggested that I write to you.

Specifically, I am interested in your opinion of the Japanese labs. These are attractive, of course, because of their relatively low fees. The quality of their work has come into question, and none here is sure that their work is comparable to that available in America. What is your opinion of the work currently being done in Japan? If none of the Japanese labs meet with your approval, could you recommend two or three American labs whose work you consider reliable?

Thank you for your help.

Sincerely,


Jane E. Buikstra

JEB:de

November 9, 1962

Mr. Orville Bullitt
1517 Locust Street
Philadelphia 2, Pa.

Dear Mr. Bullitt:

A photostatic copy of our draughtsman's drawing of our "work" area on the Plain of Sybaris is enclosed. If you would like to have a copy of the more elaborate geodetic survey map or others, please let me know.

I suspect that I neglected to thank you for that delicious dinner long ago at Centoquattordici. I did enjoy it, and especially the opportunity of meeting you and Mrs. Bullitt during your visit.

With best regards,

Elizabeth K. Ralph

EKR:pc

Beth : This is your
ASCA copy /

ek

February 9, 1963

Mr. Orville Bullitt
1517 Locust Street
Philadelphia, Penna.

Dear Mr. Bullitt:

Enclosed is Mr. McBain's research as submitted to Mr. Rainey on Thursday last. I have typed it up off his handwriting in a manner which will be helpful in future, I hope, if and when any additions are ready to be inserted. It seems to me to be a continuous sort of project, so that there is no reason why we can't keep on going from here.

I have taken the liberty of keeping one copy in the Museum for Beth and me, i.e., an official ASCA copy so that we will have the references handy which are still to be done, and the form in which to continue with their typing. The shorter ones in Latin I should have on my shelves at home and I shall try to feed you a few more sheets, so to speak, before I leave for Gordion in mid-March.

This looks like not much done, but I believe Mr. McBain looked up many references and found them in his opinion unworthy, as not being concerned with topography. If you want any or all of them regardless of their subject-matter, we shall go ahead.

With best regards,

(Miss) Ellen Kohler

December 20, 1972

Mrs. John Bunker
The Denver Art Museum
100 West 14th Avenue, Parkway
Denver, Colorado 80204

Dear Mrs. Bunker:

Ellen Kohler has asked me to reply to part of your letter of October 23rd.

We have finished our thermoluminescent (TL) tests of the figure of the Hacilar type, but unfortunately, the tests were inconclusive. For TL dating, we measure three components - the natural TL, the inherent radioactivity, and the susceptibility of the pottery to an artificial fixed dose of radiation. This figure (our No. P-T-306) had very low natural TL, no inherent alpha activity, and unusually low susceptibility to the artificial dose.

These atypical results make us suspect too that the figure is not genuine, but we must state that we were unable to date it.

We shall return the figure under separate cover.

Sincerely yours,

Elizabeth K. Ralph

ER/sa

cc: Dr. Ellen Kohler, University Museum
Mr. David Crownover, University Museum



The British Museum

Research Laboratory 39 Russell Square London WC1B 5DA
Telephone 01-636 1555

Your reference

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

Your reference

Date 6th November, 1974

Dear Dr. Ralph,

Very many thanks for your letter of October 16th kindly inviting me to visit your laboratories. I know this would be very beneficial to me and I greatly look forward to my visit.

I am now attempting to arrange official leave of absence from the Museum here in order to make the visit which I hope will be around March next year. I will write to you again as soon as I have a firmer idea of my plans.

With kindest regards.

Yours sincerely,

Richard Burleigh
Richard Burleigh



YOUR FILE NO.

OUR FILE NO.

DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES

NATIONAL PARKS BRANCH

FORTRESS OF LOUISBOURG
RESTORATION SECTION

LOUISBURG, NOVA SCOTIA

March 25, 1964

Professor Elizabeth Ralph,
c/o NATO Paleomagnetism,
Department of Physics,
The University,
New-Castle-Upon-Tyne,
England.

Dear Professor Ralph:

This letter will confirm the subject of the discussion you had today by long distance telephone with the Senior Archaeologist. Since you will be occupied after the conclusion of the conference on the latest techniques in remanent magnetism, we would very much like to have Mr. Burgh of Princeton University stop here at the Fortress of Louisbourg. Since he will presumably be travelling home sometime after the 11th of April, it would not be greatly out of his way to arrange to fly to Sydney, Nova Scotia. There are flights here from Gander, Newfoundland and from Halifax, Nova Scotia. If Mr. Burgh can arrange his flight to get him to either of these airports, there are several flights a day to Sydney and we will meet him in Sydney.

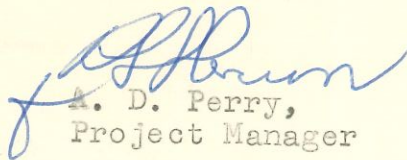
If there is some question as to whether his travelling allowance would pay for this detour, we will draw up a small contract which will allow us to reimburse him for the cost of the detour. Needless to say, we will house and feed him while he is here, and provide whatever working space and equipment we can.

.../2

As you know, we are anxious to take the samples of fireplace basés and kiln floors as soon as possible so that necessary restoration or reconstruction work can proceed. Since the possibility of establishing relative dates for the different fireplaces would be very important to our work, it is fortunate that Mr. Burgh may be available. We are also anxious to cooperate in the establishment in the series of magnetic dates for North America.

We are looking forward to having Mr. Burgh help us on this, and to show us how to take samples ourselves in the future. Since he will be coming fresh from this conference, he will be in the best possible position to do this.

Yours sincerely,


A. D. Perry,
Project Manager

replied 6 April -

Burgh arr. c 16 April

Not to expect results before
many, many months

Dear Ruth,
 Some preliminary results from Louisbourg. Would you like any samples (Louisbourg or Fort Latour) for thermoluminescence?
 Hugh

[BARRATT]
 Geology Department,
 Princeton University,
 Princeton N.J.
 November 6, 1965.

Dear Edward,

Below are the results of measurements on eight of the chateau oven bricks.

BRICK	DECLINATION (degrees)	INCLINATION (degrees)	INTENSITY (e.m.u.) ⁻²
3	332.8	69.1	1.46 x 10
4	346.7	71.4	9.45 "
10	357.1	74.5	1.38 "
12	353.3	76.3	1.55 "
14	337.1	74.7	1.27 "
16	337.0	73.5	3.16 "
19	326.0	76.0	8.07 "
21	330.7	71.6	4.72 "

Mean Declination = 340.1

Mean Inclination = 73.4

Dispersion Parameter k = 421

$\alpha_{95} = 2.7$ degrees

ARCHAEOMAGNETISM
 at
 Louisbourg,
 Nova Scotia,
 Canada

Values of declination (from Dominion observatory)

1957 - 26° 15' W

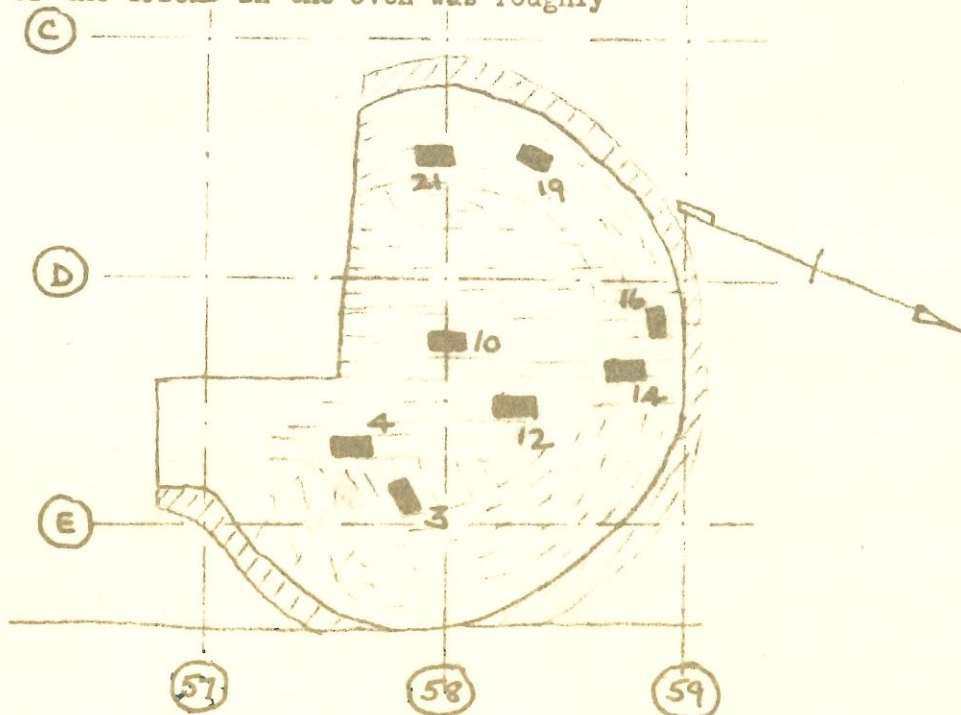
1961 - 26° 06' W

ΔD is in easterly direction

My value is 19.1 W!

A few points:

1. The location of the bricks in the oven was roughly



2. The dispersion parameter k indicates the tightness of the grouping of the set of directions - the larger the value of k , the better the grouping. The value above is pretty satisfactory.
3. α_{95} is the semi-angle of a "cone of confidence" which can be drawn around the mean direction. There is only one chance in twenty that the true mean direction lies outside this cone of confidence.
4. I cut one inch diameter cores for the measurements. The eight results were obtained using only the top inch of such cores. Measurements made on the remainder of the core tend to differ slightly from those made on the top one inch ; for example, the

results from brick 10 were	DECLINATION	INCLINATION
Top	357.1	74.5
Middle	361.0	77.9
Bottom	354.1	83.3

There is a good chance that the bottoms of the bricks weren't heated sufficiently in the oven to wipe out all the magnetization acquired during their manufacture.

5. I've mislaid the variations since 1730 of declination and inclination in eastern Canada. Could you send me an extra copy?
6. I am doing further measurements;
 - (i) to get rid of any viscous remanent magnetization - this should improve the above accuracy;
 - (ii) to find out whether or not the bricks retain any of their original (kilning) magnetization;
 - (iii) a determination of the intensity of the earth's magnetic field at the time the bricks were last heated.

I've been away all summer in the Beartooth Mountains in Montana. Just great!

Please send me a recent photo of the restoration work.

Best regards,

Hugh Hough

Burlingame Associates
510 S. Fulton Ave.
Mount Vernon, N.Y.

February 12, 1963

Dear Sirs:

At Mr. Bernard Greenberg's suggestion we are shipping to you

- 1 Brush Recorder BL 201 RS
- 1 Brush Amplifier BL 905.

We plan to use these in conjunction with a new CIC Model 3104B amplifier and D3PB differential input mode to monitor telluric ground currents (approximately 0.40 mv/kilometer).

Will you please put the Brush recorder and amplifier in good condition and make any revisions to them that are necessary. Desired operating speeds are 1, 5, 25 mm/sec.

I shall send you a purchase order as soon as I receive your estimate. Please include ordering information also for chart paper.

I plan to leave for Italy with this equipment on March 13th, and would, therefore, appreciate it if these units can be returned to us by March 8th.

Sincerely yours,

Elizabeth K. Ralph

Elizabeth K. Ralph

2/20 \$309.50

February 12, 1963

Dr. Bernie List
Apparatus Division
Texas Instruments, Inc.
6000 Lemmon Ave., P. O. Box 6015
Dallas 22, Texas

Dear Dr. List:

We appreciated your coming here and telling us about the TI magnetometer.

Dr. Rainey is now in Guatemala so that I don't know about any subsequent arrangements that may have taken place. However, I thought that I would let you know that I have ordered a Differential Amplifier (cic Model 3104B plus cic Differential Input Mode Model D3PB) and that we shall adapt a Brush Recorder BL201RS and Amplifier BL905 for use with this to monitor telluric ground currents at Sybaris.

I think that these measurements will be quite interesting, especially in combination with your helium magnetometer.

With best regards to you, Dr. Green, and Mr. Birch,
I am,

Sincerely yours,

Elizabeth K. Ralph

EKR/deh
cc: Dr. F. Rainey, Univ. Mus.

April 22, 1972

Dr. Darrel Butterbaugh
2726 N.E. 31st Court
Pompano Beach, Florida 33064

Dear Darrel:

Plans for the Mexican trip were unsettled until last week because no one knew when Sam Carpenter (and his plane) would be free. However, ~~Burke~~ took off last week and Fro, today (on commercial flight). They plan to be in Mexico for only a few days, then fly over Chaco Canyon (if Sam appears). With all of this uncertainty, I think that you would have difficulty in catching them.

Are you still planning to come back to MASCA in May? I hope that you are. Our present volunteer, Julia Biddle, is leaving in May, and there is plenty of work to do.

With best regards to you and Jan.

Elizabeth K. Ralph

EKR/ek

Attention: Mr. David Crownover

Re: Board Meeting and MASCA

September 26, 1972

I should like to suggest that Dr. Darrel Butterbaugh be given the title of Research Associate in MASCA.

Dr. Butterbaugh is a research chemist, retired from the Rohm and Haas Company, and has been volunteering his time for three days a week in the MASCA labs. He has been working in the Information Center and is now applying his chemical knowledge and his access to the newly developed Rohm and Haas polymers to the problem of the consolidation of mud bricks.

For the experimentation with the consolidation of mud bricks -- adobe walls, etc., a small amount of funds will be required.

Shipping (mostly mud bricks from Arizona to Philadelphia)	\$200.00
Miscellaneous Supplies and Chemicals (other than Rohm & Haas polymers)	<u>300.00</u>
Total	\$500.00

It is hoped that this amount can be appropriated from the Macauley Fund for research in the Americas.

I hope that the Board will act favorably upon these two requests.

Elizabeth K. Ralph
Associate Director of MASCA

→ Betty
DOTB File

BUTTER BAUGH ✓

November 8th, 1973

Dr. James Ayres
Arizona State Museum
University of Arizona
Tucson, Arizona 85721

Dear Jim,

I hope you are having a successful sabbatical and that your trips to the Scandanavian countries and to Easter Island were a success. The next time I see you I hope I can see some of the results of your work.

Just to bring you up to date on the adobe brick project, this summer under the auspices of the University here and the Park Service in Albuquerque we placed samples under test at Chaco Canyon and at Pecos National Monument. At Chaco Canyon with Al Hayes we have 8 test segments on a pit house and a Kiva under evaluation. Each of these are about 25-50 sq. feet. In addition we have segments of Anastasi stone wall under test. Here we made an attempt to impregnate the foundation of the wall by excavating underground to its base and treating with resin.

At Pecos we attempted to treat some 300 year old adobe walls. However I am unhappy with this test in as much as these were badly eroded, soft and we have no firm base for the resin impregnation and coating. It was somewhat like trying to treat a feather pillow. We also have under test at this location some resin impregnated mud mortar and some resin impregnated cast new adobe bricks. I really need a better test specimen outdoors for the adobe wall treatment. At this time I do not feel justified in asking the University here to send me to Arizona even though I am sure you could find me a suitable wall. I still plan to be in the Arizona/New Mexico area next Spring to inspect the existing tests and perhaps at that time start a more appropriate adobe evaluation.

Also to bring you up to date on the most recent research lab work here, I have several resin treatments that can withstand 30400 hours of heavy rainfall (1200 inches per hour). It is also possible to obtain almost complete "no soak" characteristics with as little as 2-4% resin solution impregnated by a base treatment from a wet paper wick. This lends considerable hope to a base foundation treatment that will lick the ground water problem. Further to this I have been able to institute a simulated ground water test in the lab which shows marked failure of an untreated chunk of adobe brick but shows no failure of a treated chunk even when the bottom of the chunk has been filed away to expose the inside

of the raw clay to the wet paper wick.

We have been studying the effect of these resin impregnations on soft Chaco sandstone. Some of our small particlessize emulsions even at the 16% concentration will soak into these rocks by as much as 1 to 1½ inches. Such treated material is water repellent and again when subjected to the ground water simulator it grows salt deposits but does not weaken when the salt is dissolved off and the stone is dry. In contrast the untreated sample of the same stone when placed in the simulator grows prolific amounts of salt and when soaked and dried has badly softened even to the point of being hardly more than tightly packed sand on the lower 1/3 of the stone chunk. This is phenomenal failure of untreated stone when subjected to distilled water movement by means of capillary action through the stone, in contrast to infinitesimal deterioration of the treated stone sample. Please realise that the treated stone sample had been sawed off on the bottom to expose the inner core of natural stone which permits the movement of water inside the chunk of rock. Of course a chunk of rock treated completely on all sides does not even wet in this ground water simulator. Sound good?? I am very much enthused. I am sorry I have to suspend operations for 6 months until I get back to the Museum, but I can't let this job take more than half my retirement.

Jan and I will be in Florida until about next mid March - 2726 N.E. 31st Court, Popano Beach, Florida 33064, phone 305-942-2616. Lets keep in touch and best regards.



Darrel Butterbaugh

PS I have licked the gloss problem on adobe and even on stone by the simple expedient of dusting finely powdered soil or stone on the sample while still wet from the second coat. This dust is firmly attached and will not come off with the showering but does dry out immediately to leave a natural appearing surface.



DESARROLLO INTERNACIONAL
DE COOPERATIVAS AGRICOLAS

4a. Calle 1-25, Zona 10.
Guatemala, C. A. Cables: FECOAR
Tels. 64734 - 67473

November 22, 1976

Mr. Darrel Butterbaugh ✓
2726 N.E. 31st Court
Pompano Beach, Florida 33064

Dear Darrel:

It was good to hear from you and I regret answering so late. Your letter arrived just about the time I left Guatemala for one month's leave. By the way, your rat poison did arrive. Many thanks.

I examined the experimental walls on Saturday, Nov. 20th at Chimaltenango. They are in excellent shape and they look exactly as they did when you last saw them. The walls have now gone through one rainy season - perhaps 30" to 40" of rain. The superficial checking is still there, of course, which occurred when the adobe material dried after being laid up. There is no erosion visible in or around these small cracks. Except for the weeds which have grown up around the test site, the trials look exactly as they did when we finished them. Also, there is no crumbling or "dusting off" apparent when one touches or rubs the walls. So far, both materials appear to work very well; I could not judge which is better.

I have taken color photos of the trials (not transparencies) and will send them to you soon along with the negatives. Your archeologist friend has not yet requested the solution for additional trials at Quirigua.

I will be staying for some time in Guatemala working on another project and will be glad to help you from here if I can. Come back again when you can.

Yours,

David Fledderjohn

DF:sf

cc: Frank Kenofick/AID

P.S. copy to your Florida address

Asesores de:

