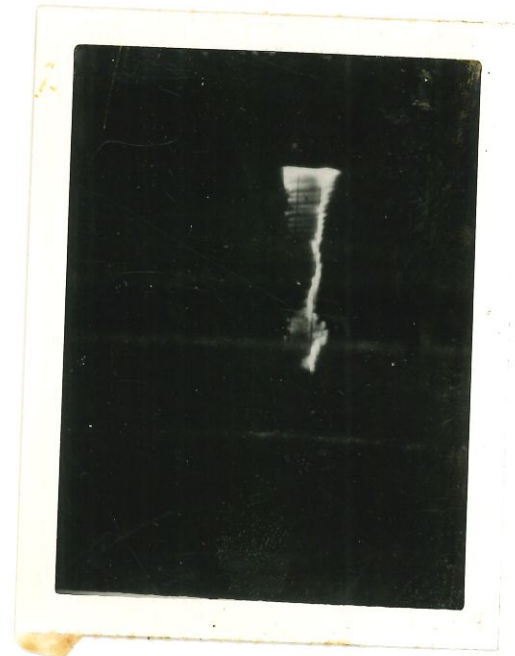
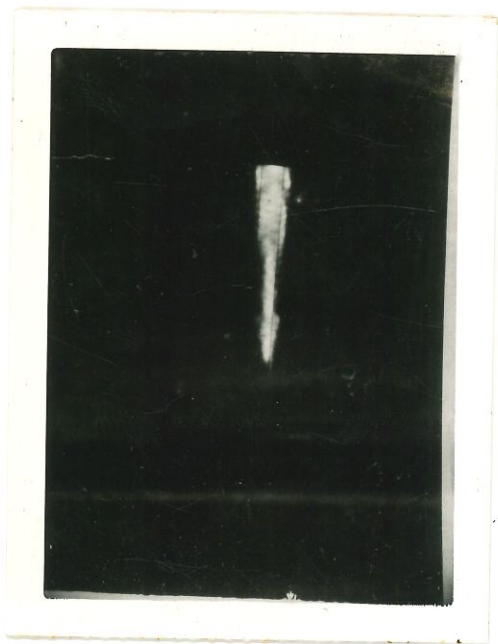
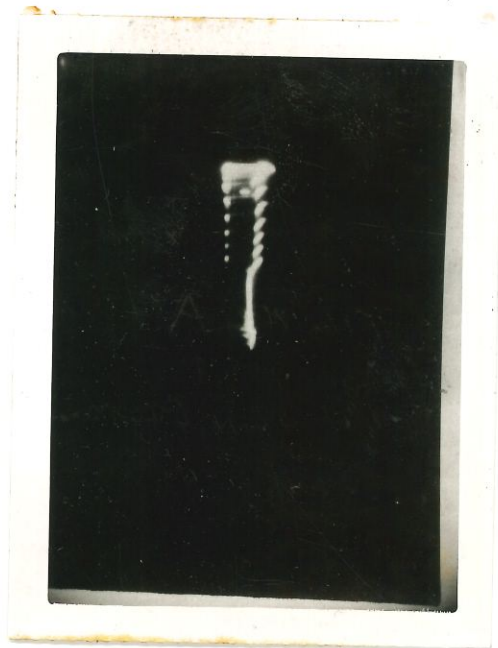
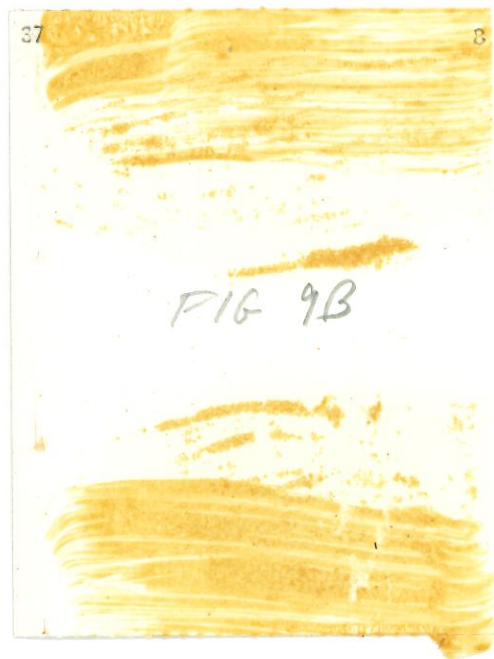
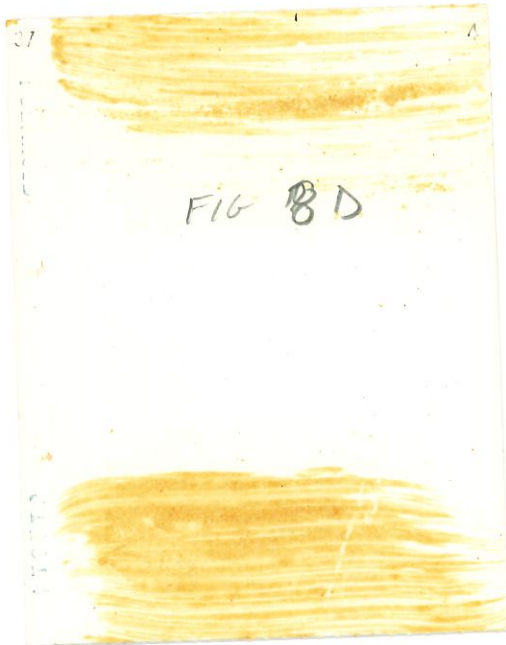
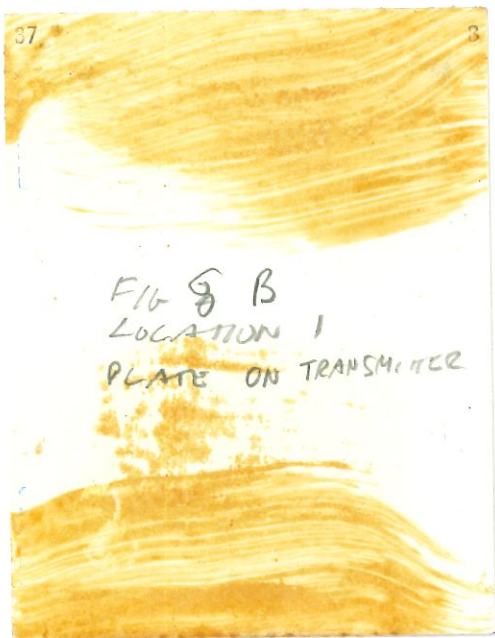
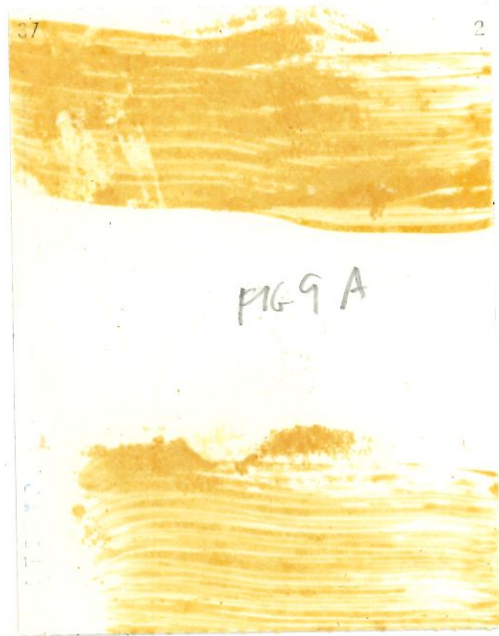
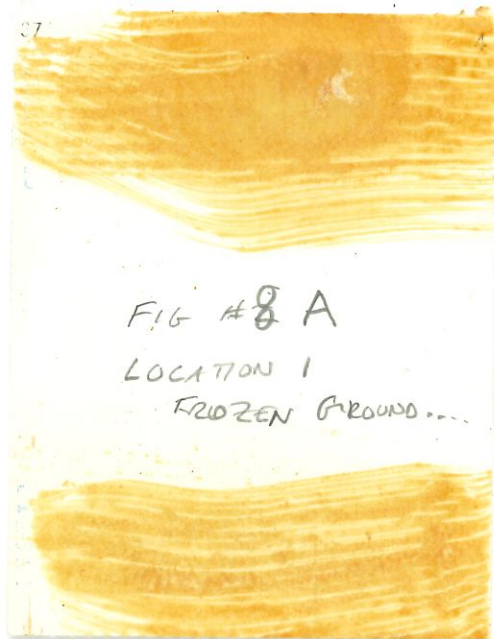
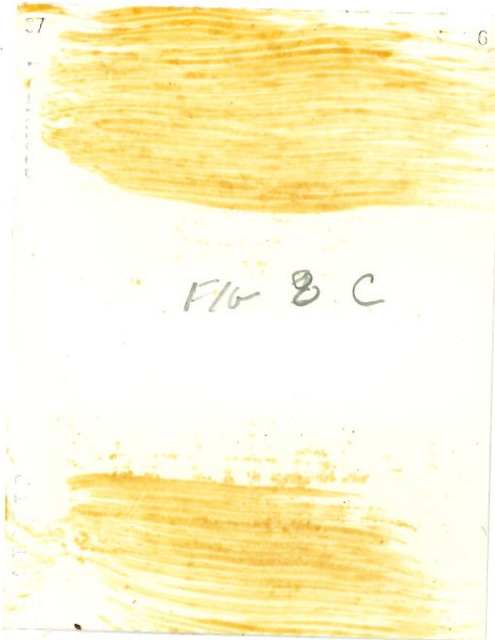


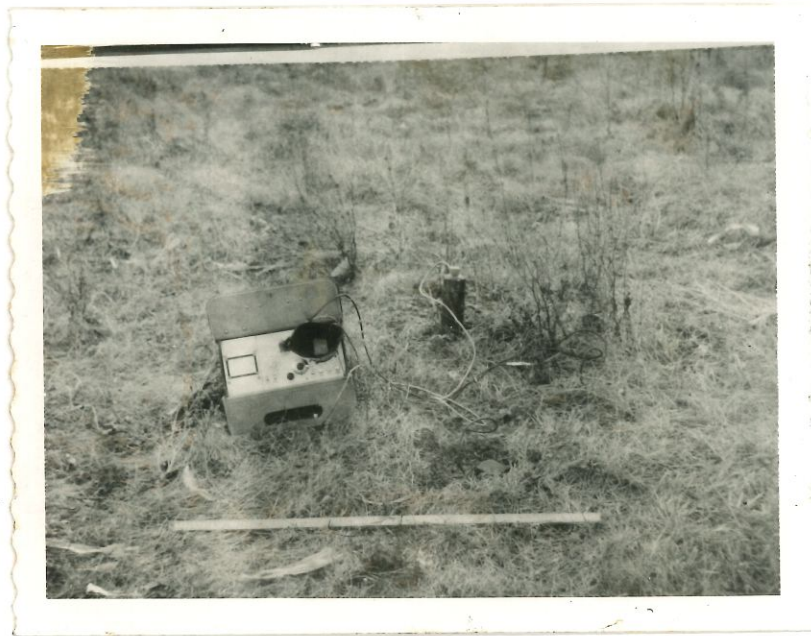
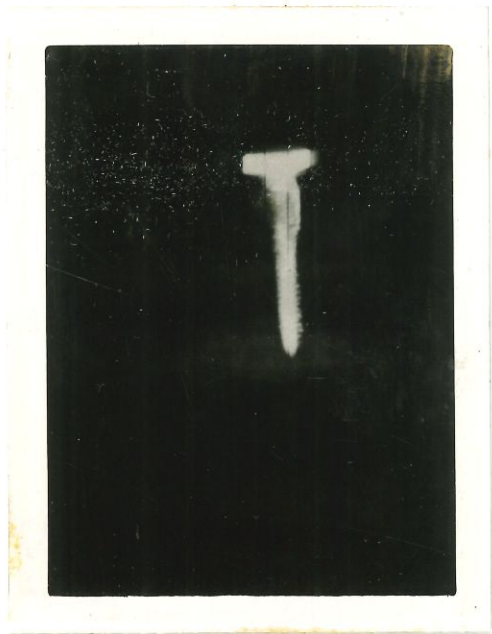
PHOTOS: PRINTS

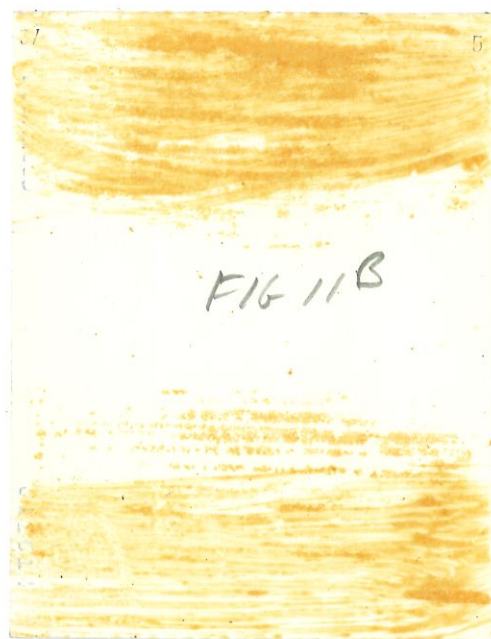
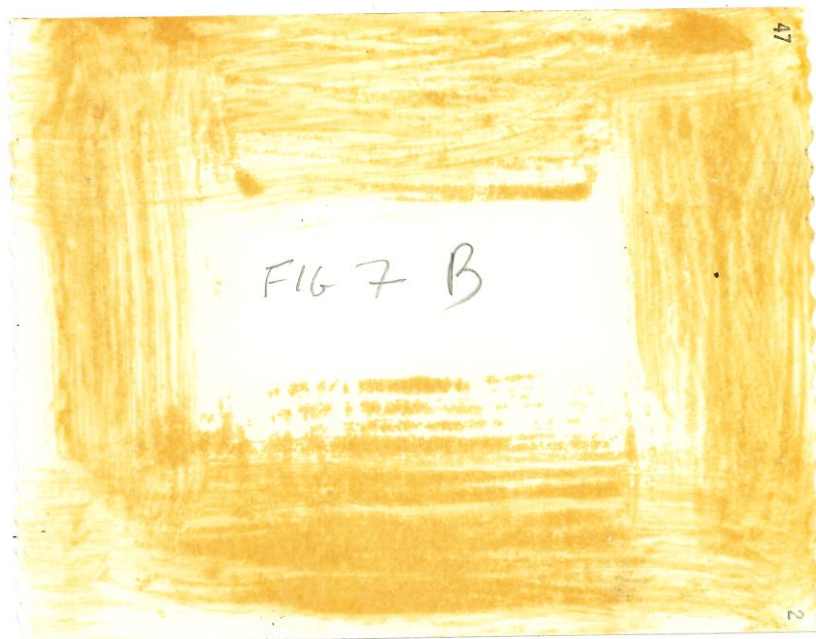
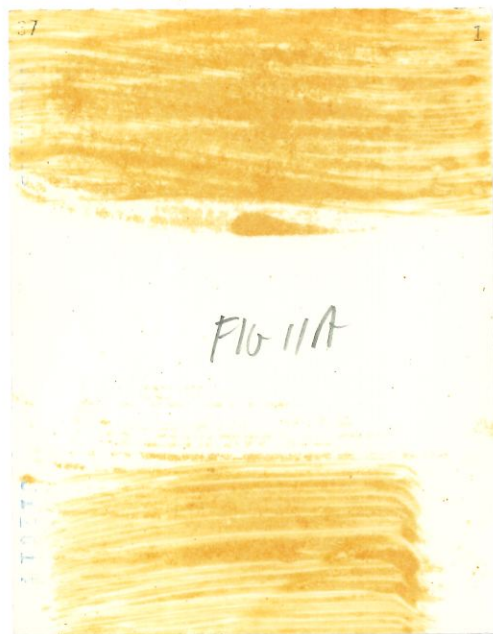
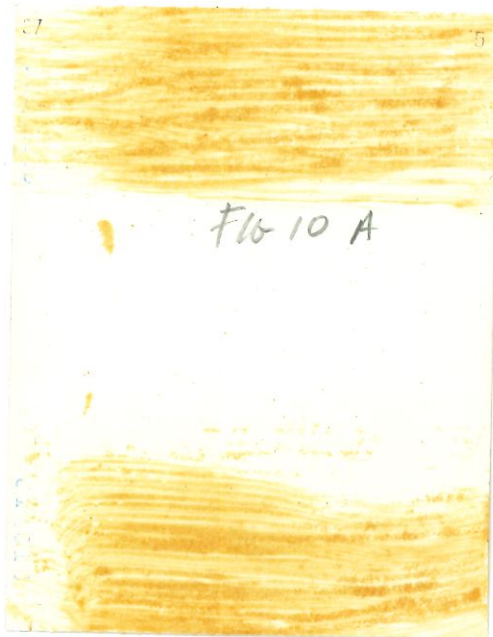
MAC LAUGHTON (REPORT)

JAN 11, 1962









*Mc
Techniques*

January 11, 1962

Mr. Eugene McDermott
13500 North
P. O. Box 5474
Dallas 22, Texas

Dear Mr. McDermott:

Dr. Rainey left for Italy before this report from Gray McLaughlin arrived. He suggested that I forward it to you in his absence.

We are sorry that the delay has been so long. Dr. Rainey is looking forward to discussing these matters with you when he returns from Italy, which he hopes will be on January 17th or soon thereafter.

Sincerely yours,

Elizabeth K. Ralph
Carbon-14 Laboratory

Encl.

EKR/deh

MacLAUGHLIN ELECTRONICS

PERKIOMENVILLE, PENNA.

INSTRUMENTATION

AUTOMATION

RESEARCH

MANUFACTURING

SEISMIC PROBE

Measurements made with the first experimental seismic probe indicated further field work was desirable before proceeding with the building of a second model. Information was needed concerning velocity of seismic waves in surface soils to establish ranges (travel times), and the design of the indicator range circuits. Also the attenuation at various frequencies in soil would determine the sensitivity of the equipment and also the power required by the transmitter. Coupling the transmitter(transducer) and the receiver (geophone) to the ground becomes increasingly important as the range and frequency of operation increases.

For the ranges used in Archeological work,(100 ft. max.) coupling is not critical,however, poor coupling requires special design of the transducers and geophones to reduce "ringing" which will otherwise obscure weak echos and mask anomalies near the surface.

A brief description of the operation of the equipment follows. The seismic probe consists of a transmitter, receiver and indicator, (see Figure #1.). The transmitter used in the experimental unit is an

electromechanical impact device operating at 10 pulses per second. The transmitter emits a wide range of frequencies, from 50 to 15,000 cycles per second. Experiments can be made at various frequencies by changing the frequency characteristics of the receiver, either by pickup design or by filters. The present pickup is a piezo electric type with broad response, permitting the use of filters to obtain transmission data at different frequencies.

Signals are displayed on a radar type cathode ray tube. The distance or depth to an anomaly is indicated directly on the scale of the indicator. (see Figure #2.).

The sweep starts when the transmitter (T) emits a pulse (O) point on the indicator. The beam of the indicator moves downward at a constant rate.

The transmitted pulse travels down until an anomaly (a) is encountered, a portion of the pulse is reflected upward, picked up by the receiver and applied to the indicator. During the time the pulse traveled down and up, the beam of the indicator moved from O to point (a). The signal deflects the beam at (a). The distance on the scale from O to (a) indicates the echo time or depth of the reflecting anomaly when the characteristics of the soil are known. Additional echos from greater depths will be displayed at corresponding distances on the oscilloscope screen.

The speed of the seismic waves in the soil in this area is about

2000 ft/sec. Therefore a depth of 10 feet would result in a travel time of about .010 sec. or 10 milli seconds after the transmitted pulse. Each .001 second is approximately equal to a foot. In rock, the speed of seismic waves is much greater up to 20,000 ft/sec. In this case, .010 second would equal 100 feet depth.

However, once the time and actual depth are determined for one area, and soil type, the scale can be interpreted directly in depth.

The equipment was used in the Green Lane area which is shale with deposited glacial boulders up to house size and a nearby horizontal underlying layer of trappe rock.

Several things became evident.

First:- Poor results under trees. Apparently the tree roots and rootlets absorb the seismic wave. This effect was also noticed at Dr. Rainey's home in Valley Forge.

Second:- Poor results when working on heavy turf. It is necessary to obtain good, firm ground connection. Signals are present but faint. But penetration below root level increases signal many times.

Third:- Frozen ground is not difficult except for the hardness. But apparently the rigid surface of the ground transmits low frequencies very efficiently as the pickup was overloaded at the low frequencies when it was adjacent to the transmitter.

Note: This effect will be eliminated when a single frequency transmitter is used as the low frequency output of the broad range transmitter is very great.

Fourth:- Thawing ground resulting in several inches of very soft mud requires a different coupling method as the shear method of coupling used on harder ground is not effective and a coupling using a diaphragm, similar to sonar units, is more effective.

Several photographs showing echo signals are attached and illustrate operation of the experimental unit. To facilitate comparison of signals, the scale used in all photographs is the same, 205 milli second, corresponding to approximately twenty~~40~~ foot depth.

Diagrams of the location of the transmitter and receiver with surrounding objects and anomalies are illustrated in Figure #3 and Figure #4.

One set of photographs, Figure #1, is of particular interest as it illustrates the difference in detail, from very low frequencies to that obtained from higher frequencies. The one photo illustrates echos below 400 cycles and the other photo illustrates the increased definition using frequency of 10,500 cycles. The echo detail of the high frequency signal apparently indicates the structure of the trappe rock layer. The depths indicated are only approximate as exact records were not kept when drilling was in progress. A local firm with rotary drill rigs has been contacted and is very cooperative. This will permit calibration and distance measurements of soils and rock layers.

However, the intended use of the equipment, location of sites, will require use in the field where digging will permit correlation of observation and results.

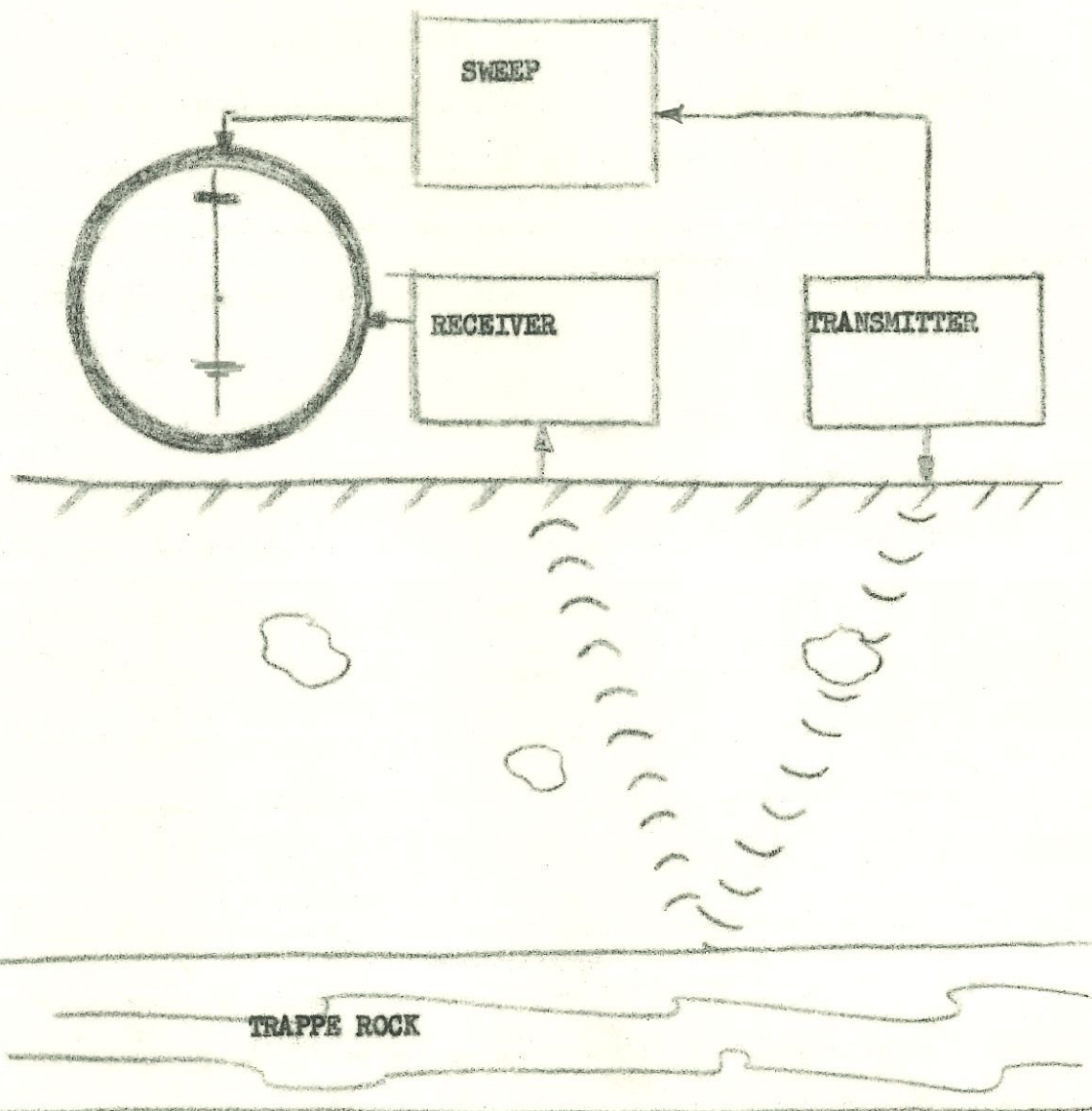


FIGURE #1.

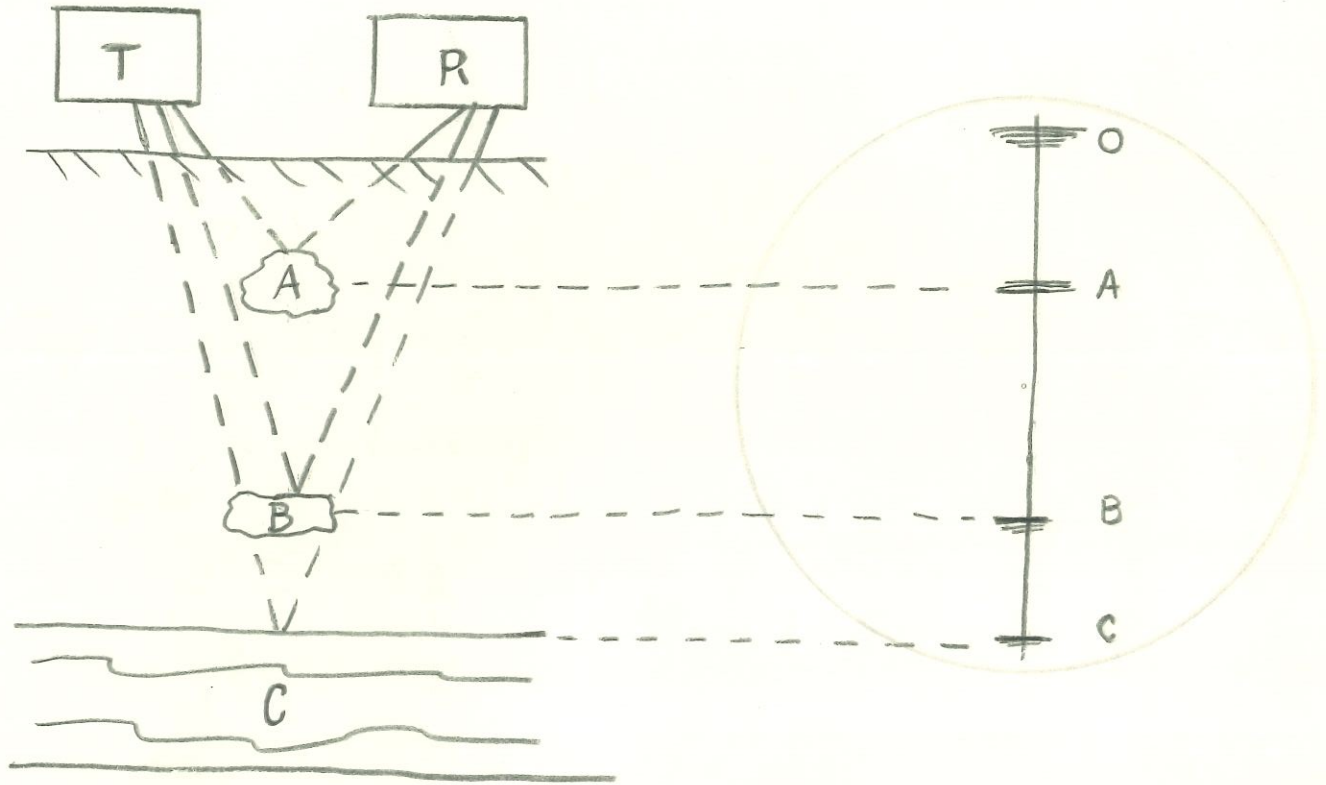
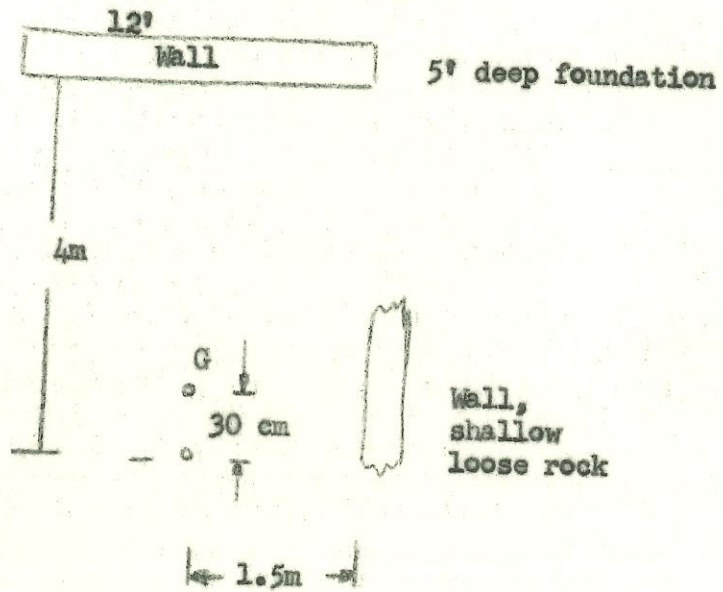


FIGURE #2.



LOCATION #1.

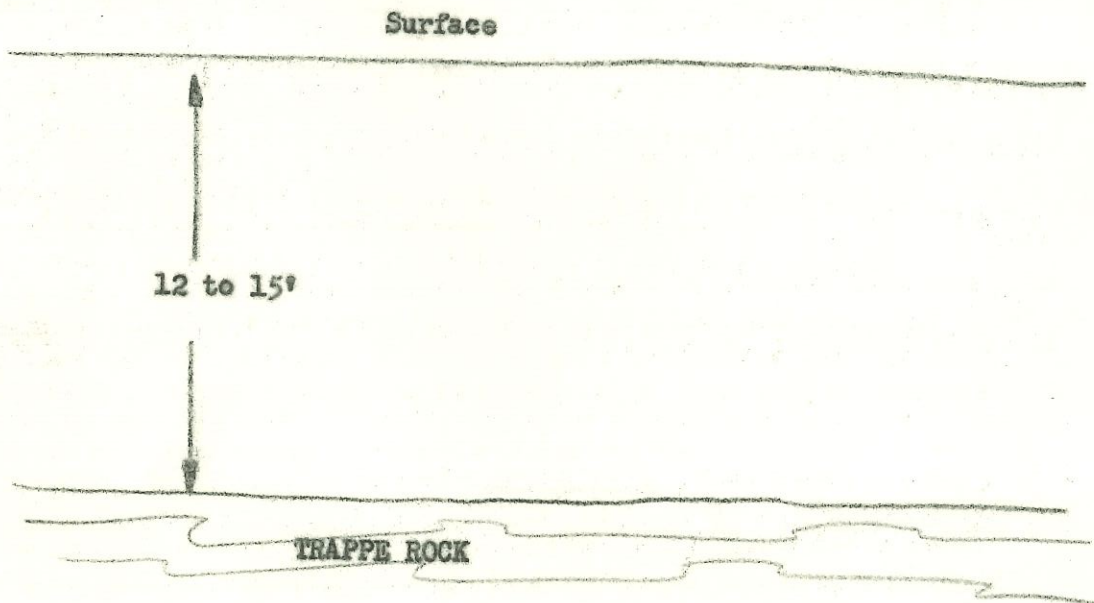


FIG. #3

LOCATION # 2.

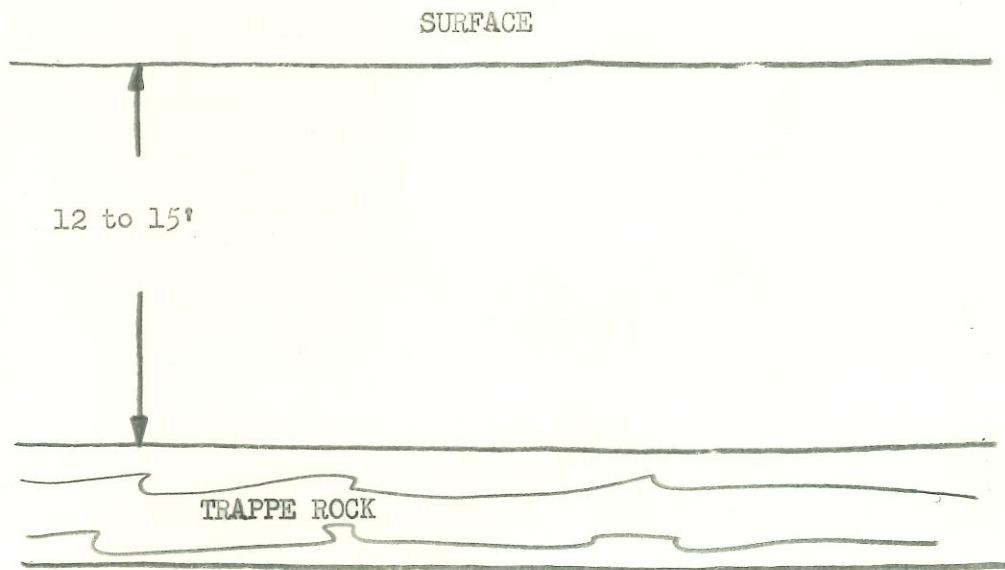
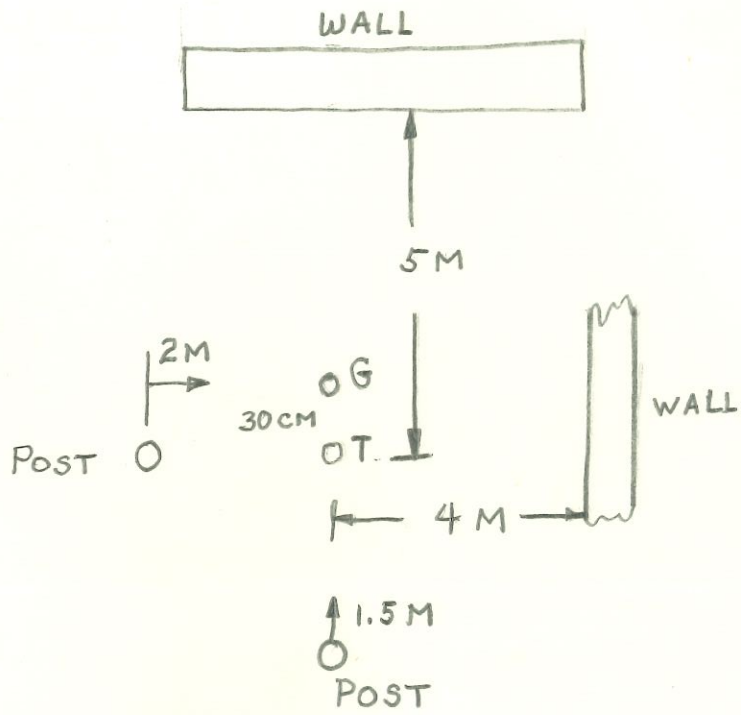
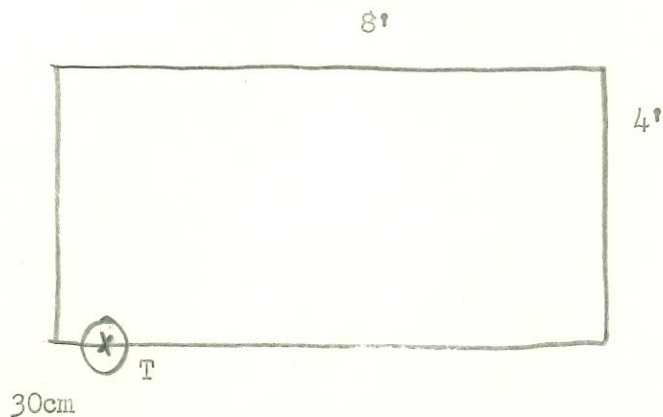


FIG. # 4

LOCATION # 3.



(R)

CONCRETE TANK

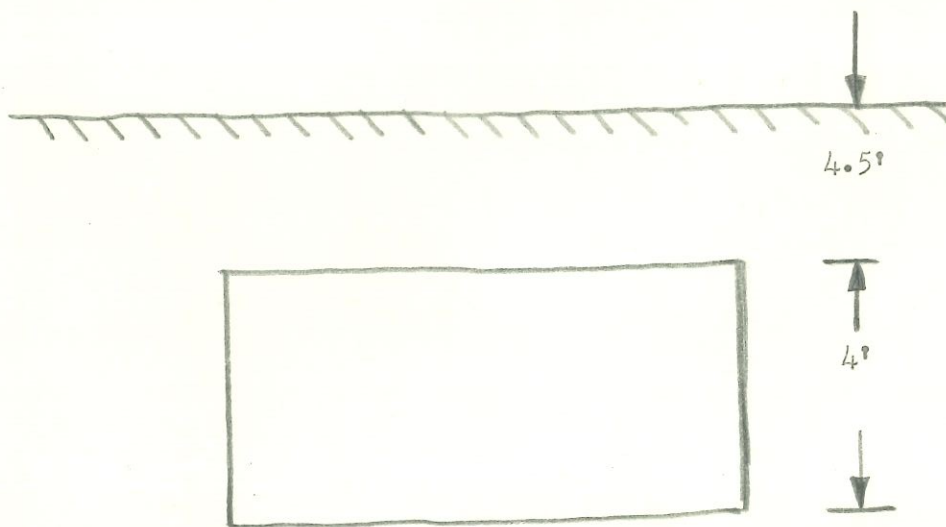


FIG. # 5

LOCATION #4.

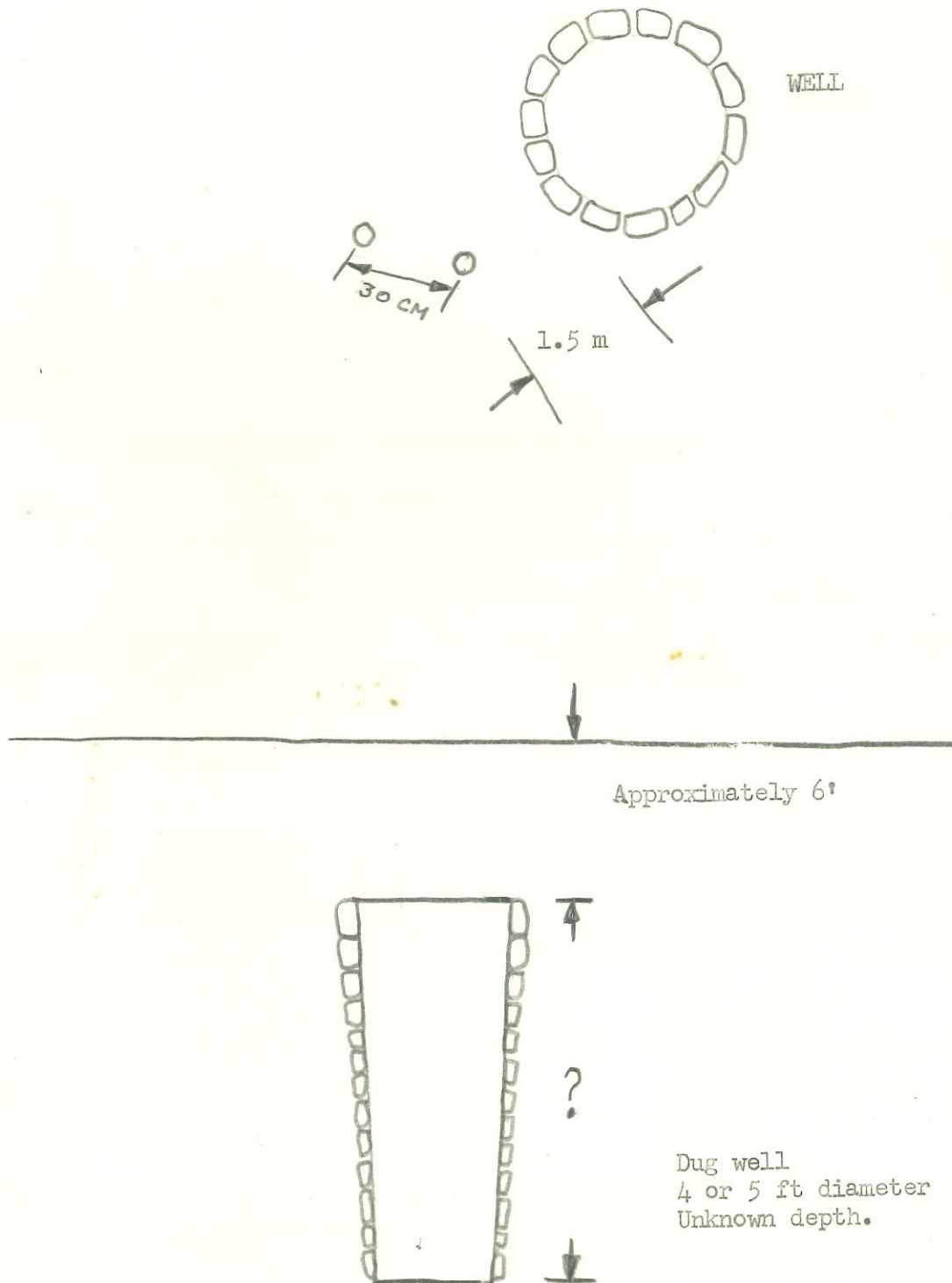
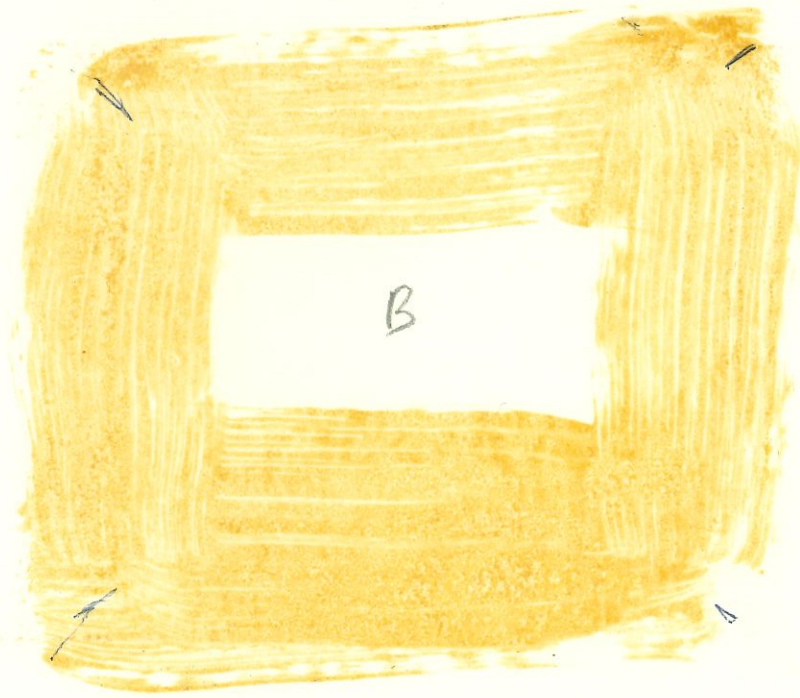
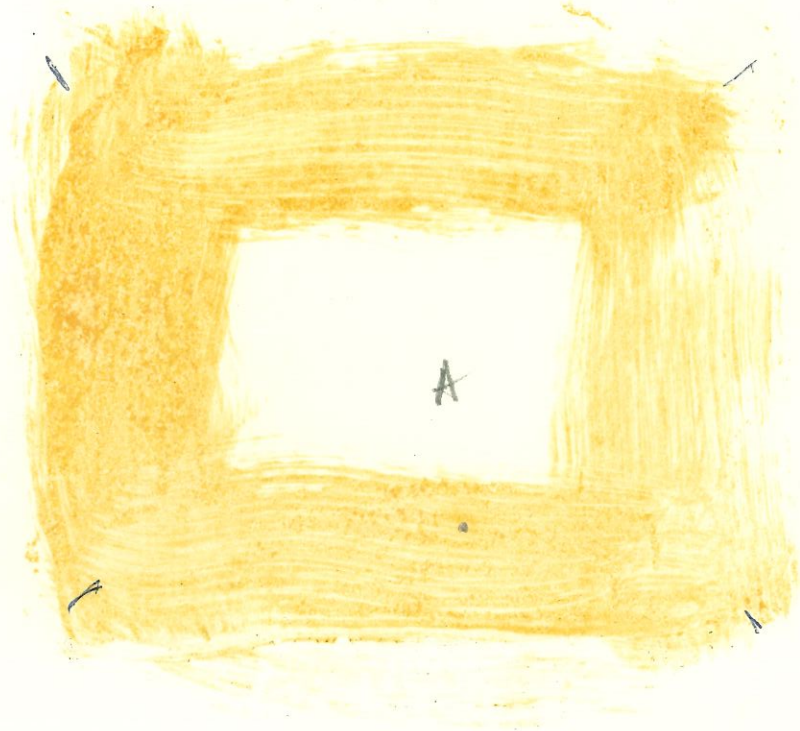


FIG. # 6.

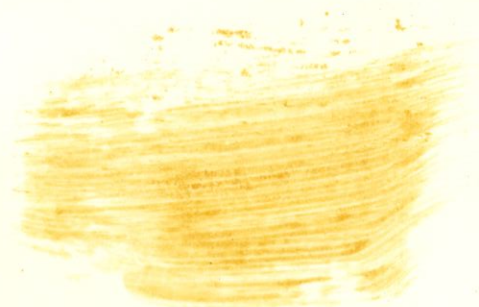


Seismic Probe in field Location #4.

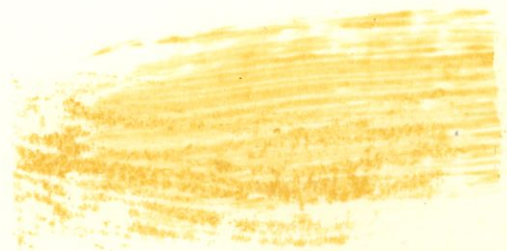
FIG. #7



A



C



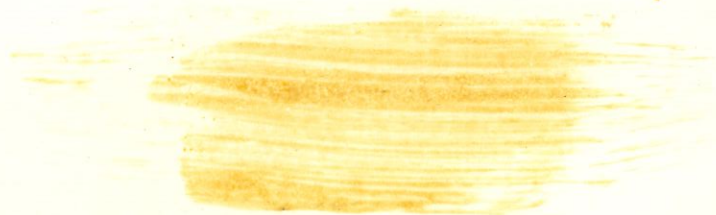
Location #1 Frozen
ground showing over-
load of receiver.



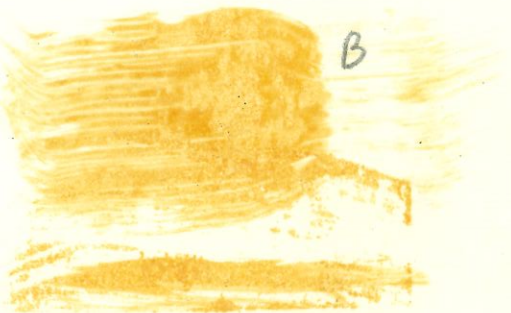
Location #1. Plate
on transmitter, soft
ground due to thaw.



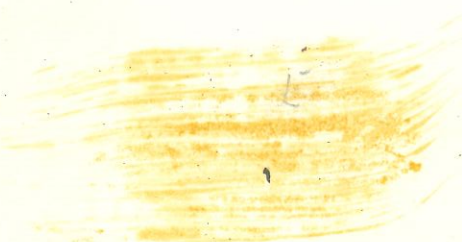
Location #1. Plate
on transmitter & Receiver
soft mud.



D



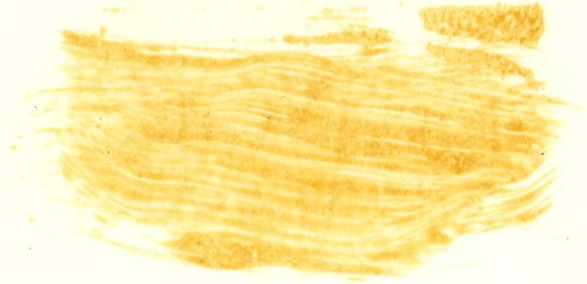
B



Location #1.
Same as left - deeper
in mud.



A



B

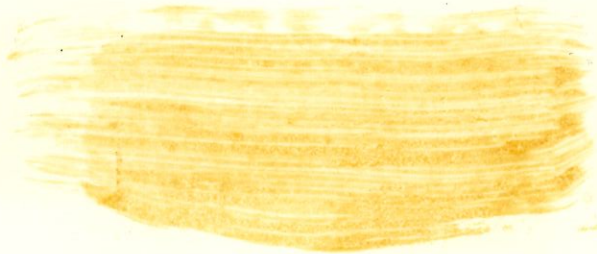


Location #1
Deep in mud -
High gain

Location #2
in mud poor H.F.
coupling high gain.



A



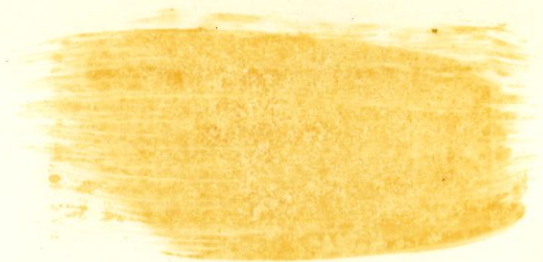
Location #3 Buried cement vault
showing shallow echo.



B



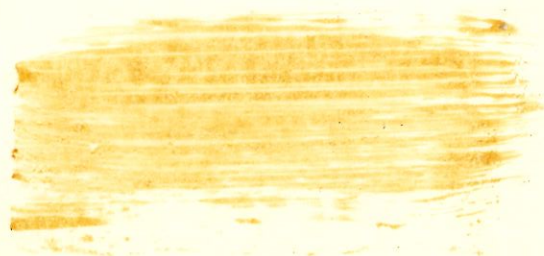
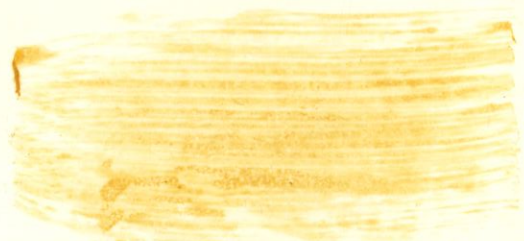
location #4 well showing elongated echo.



A



B



Frequencies below 500 cycles.

Frequency peaked 11.2KC
Some low frequency due to
frozen ground.

Both location #2.

August 22, 1962

Mr. Gray MacLaughlin
Perkiomenville
Pennsylvania

Dear Mr. McLaughlin:

I thought you might be interested
in seeing the enclosed report from Petty.

Sincerely yours,

Mrs. John Dellevigne, Jr.

Arch Tech file

The following amounts have been spent by Gray MacLaughlin (MacLaughlin Electronics, Perkiomenville, Penna.) for the construction of the Four-Channel Recorder for Texas Instruments, Inc., an instrument requested by Mr. Frederick Romberg. (Univ. Museum Order No. 100399).

April, 1962 (parts and 3 weeks labor @ \$6.00/hr.)	\$ 807.29
May (parts and 3 weeks labor)	810.33
June (parts and 4 weeks labor)	1094.22
July (parts and 4 weeks labor)	1138.78
August (parts and 4 weeks labor)	972.50
September (parts and 3 weeks labor; actual bill not rec'd)	800.00
October (parts and 1½ weeks labor; actual bill not rec'd)	400.00
November (parts and 4 weeks labor, estimated)	<u>1000.00</u>
Total	\$7023.12

The circuits for the recorder, the housing, and the amplifiers have been completed. MacLaughlin estimates that two weeks of work will be required to complete the sweep optical system and the mounting of the amplifiers and piezoelectric elements.

For the field testing and "debugging" of the instrument, MacLaughlin estimates one month of work (December). The cost of this work was not included in his original estimate.

Therefore, the total funds required in excess of the original \$5000 donated by Texas Instruments are as follows:

Unestimated expenses for construction	\$2000
Field Testing and "Debugging"	<u>1000</u>
Total Needed	\$3000

cc. G. MacLaughlin

February 12, 1963

Mr. Grey MacLaughlin
Little Road
Perkiomenville, Pennsylvania

Dear Grey,

Have enclosed 3 things for your files.

I have ordered the following:

Tektronix Portable CRO Type 321
with rechargeable batteries and
standard P-31 phosphor.

Additional Cathode Ray Tube
with Type P-7 phosphor.

CIC Model 3104 Wideband
DC Amplifier and Model D3PB
Differential Input Mode.

Ordered from Burlingame Associates who
are also renovating our Brush Amplifier and Recorder
for use with it to monitor telluric ground currents.

Excuse the haste,

Elizabeth K. Ralph

EKR:dem

MacLAUGHLIN ELECTRONICS

PERKIOMENVILLE, PENNA.

Atca file

INSTRUMENTATION
AUTOMATION
RESEARCH
MANUFACTURING

August 15, 1963

Dear Beth:

Enclosed please find schematic for Transducer Drive Circuit.

The circuit and transducer are designed to provide sufficient output for shallow reflection work. It produces a single impulse, not a wave train. It should be used with a pickup system of adequate sensitivity. If the pickup system is not efficient, an explosive source will be required to obtain sufficient energy for reflected signals.

You can determine if the pickup is of adequate sensitivity by it's response to microseisms, they are always occurring. The pickup should show response of about one fourth maximum with background noise alone. A train should be detected at several miles and a truck at $\frac{1}{4}$ to $\frac{1}{2}$ mile, depending on holes in the road. The military services already have several seismic systems for detecting sapping operations and distant machinery.

If I recall the contract wording with Petty Co., the first phase of the work was to be measurement and testing. The second phase was to build a unit for field testing with no attempt at miniaturization. Probably truck portable. I wonder if supplying Petty with equipment instead of letting them develop and build, may not be limiting the advantages you would otherwise get from Petty's contract?

The equipment they build is to become the property of the Center at termination of the contract. With the experience Petty has in the exploration field, maybe they could come up with something new. If they use only their lab equipment and borrowed items, they won't be able to supply much at termination of contract. So it is to your advantage to encourage them to build.

It has long been established that vibrations are transmitted through the ground, the problem is to use these vibrations and present them in such a manner that subterranean information is extracted. This part of the problem needs all the engineering available. By the way, did Petty do any reflecting work yet? I don't recall seeing any data.

Sincerely,

Guy



Applied Science Center for Archaeology

Asca

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

August 31, 1965

Mr. Gray MacLaughlin
MacLaughlin Electronics
Little Road
Perkiomenville, Penna.

Dear Mr. MacLaughlin:

Since I have not been able to reach you by telephone recently and do not know whether or not you may be en route to Texas to test your sonic device with Dr. Romberg and others at Texas Instruments, I am writing to say that if you are en route to Texas, please proceed with the testing.

If not, we feel that so much time has elapsed and so much money has been expended, that further delay will not insure the completion of this project. Therefore, we request that you bring all of the equipment and apparatus, circuit diagrams, and a report of your work to the ASCA labs before September 15, 1965.

Sincerely yours,

Elizabeth K. Ralph

EKR:lm
cc: Dr.F.E.Romberg
Prof.F. Rainey

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

WESTERN UNION TELEGRAM

W. P. MARSHALL
 CHAIRMAN OF THE BOARD

R. W. MCFALL
 PRESIDENT

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

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

129A EST FEB 3 66 PA078 **DUPLICATE OF TELEPHONED TELEGRAM**

P LLB51 NL PD DJX POTTSTOWN PENN 2

DR FRO RAINEY

33 AND SPRUCE ST UNIVERSITY MUSEUM PHILA

PACKAGE SENT LAST WEEK CANT MAIL CIRCUITS SNOWBOUND BETH HAS

FILE OF SCHEMATICS

MRS MACLAUGHLIN.

replied:

"package not received"

LEV 67400

3/ FGR

5	95	To	
6	✓	At	✓
7		To	✓
8			

SF1201(R2-65)

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19 66*