



FALCONBRIDGE LIMITED
202 - 856 Homer Street
Vancouver, B.C. V6B 2W2

82M-4

GEOPHYSICAL REPORT
BOREHOLE ELECTROMAGNETIC SURVEY
BAY PROJECT
KAMLOOPS MINING DISTRICT, B.C.
BY
DELTA GEOSCIENCE LTD.

SEPT. 4, 1989

G.A. HENDRICKSON, P.GEOPH.

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**GEOPHYSICAL REPORT
BOREHOLE ELECTROMAGNETIC SURVEY**

ON THE

BAY PROJECT

**BAY CLAIM GROUP
KAMLOOPS MINING DISTRICT, B.C.**

NTS SHEET 82M/4

BY

DELTA GEOSCIENCE LTD.

SEPTEMBER 4, 1989.

G.A. HENDRICKSON, P.GEOPH.

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INTRODUCTION

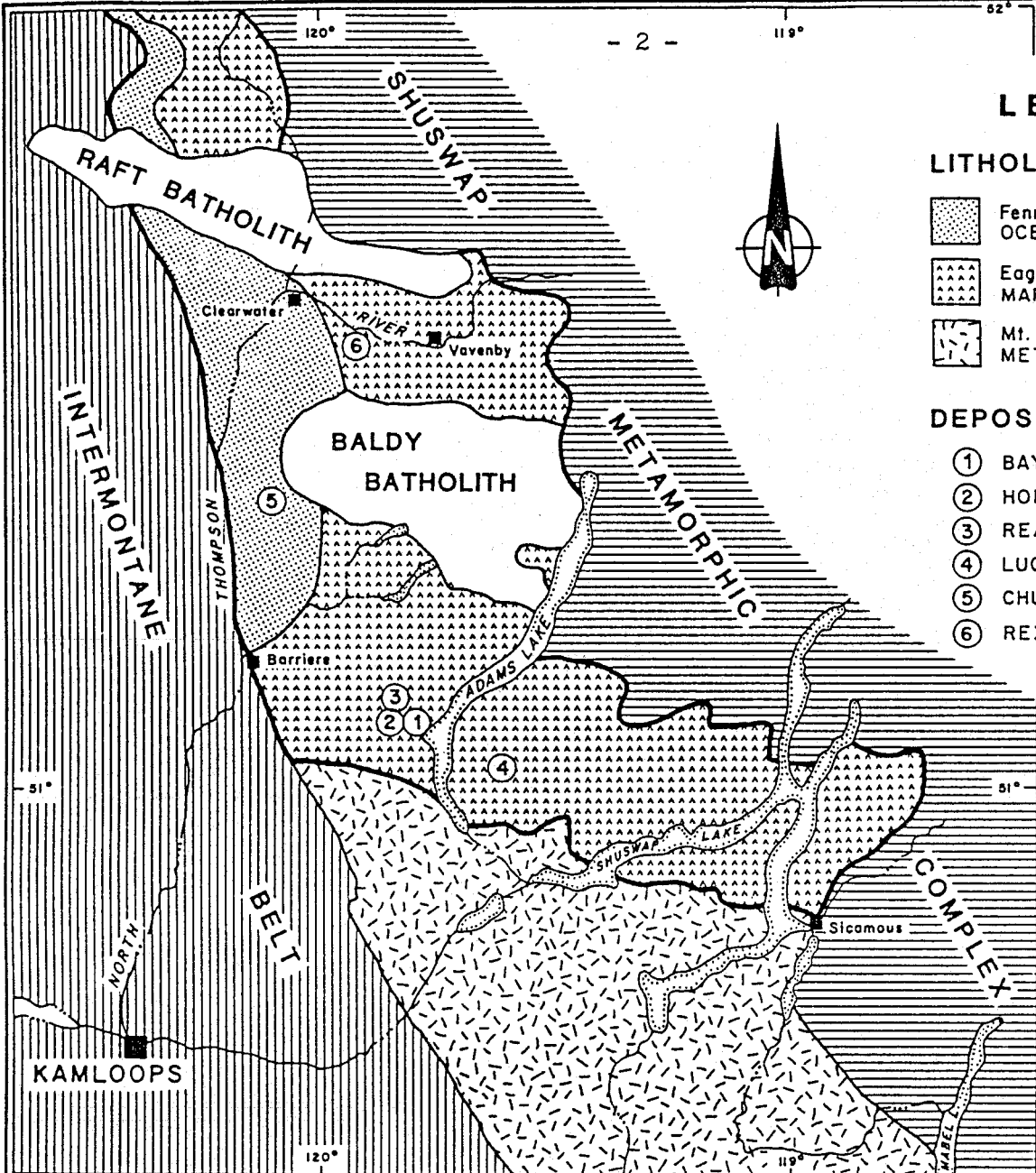
This report is concerned with a borehole electromagnetic logging program using the Remi-Melis system developed by the Bureau de Recherches Geologiques et Minieres (B.R.G.M.) of France.

The main application of the Remi-Melis system is in mining exploration, where massive to semi-massive sulphide bodies (conductors) missed by drill holes can be detected up to 100m. from the hole.

Falconbridge Ltd., the operator of the Bay Project, contracted Delta Geoscience Ltd. to log several holes during the period July 27 to August 6, 1989. The Bay Project is a joint venture comprised of Falconbridge Ltd., Cominco Ltd., and Westmin Resources Ltd. The owners of the claims are Cominco Ltd., and Westmin Resources Ltd. The objective of the work program was the detection of any conductive zones around the drill holes.




The Remi-Melis system is a hole to surface frequency EM method that aims at detecting conductive targets located around a drill hole. Basically, the system consists of transmitting an alternating current into a loop positioned on the surface of the ground and encircling the borehole, and in measuring the component of the magnetic field along the borehole axis.

Secondary currents induced by the primary field of the loop into any nearby conductive bodies will produce secondary magnetic fields which, in addition to the primary field, are measured by the down hole Remi probe. The in-phase and out of phase components of the total axial (borehole) field with respect to the primary field, are determined through a reference magnetic sensor located on the surface adjacent to the drill hole.



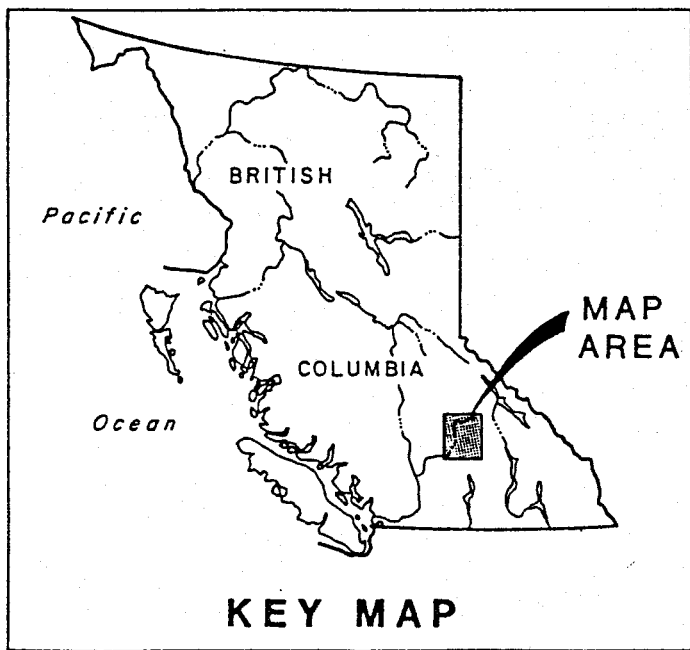
LEGEND

LITHOLOGY


-  Fennel Formation : OCEANIC BASALTS
-  Eagle Bay Group : MAFIC & FELSIC VOLCANICS
-  Mt. Ida Group : METAMORPHIC COMPLEX

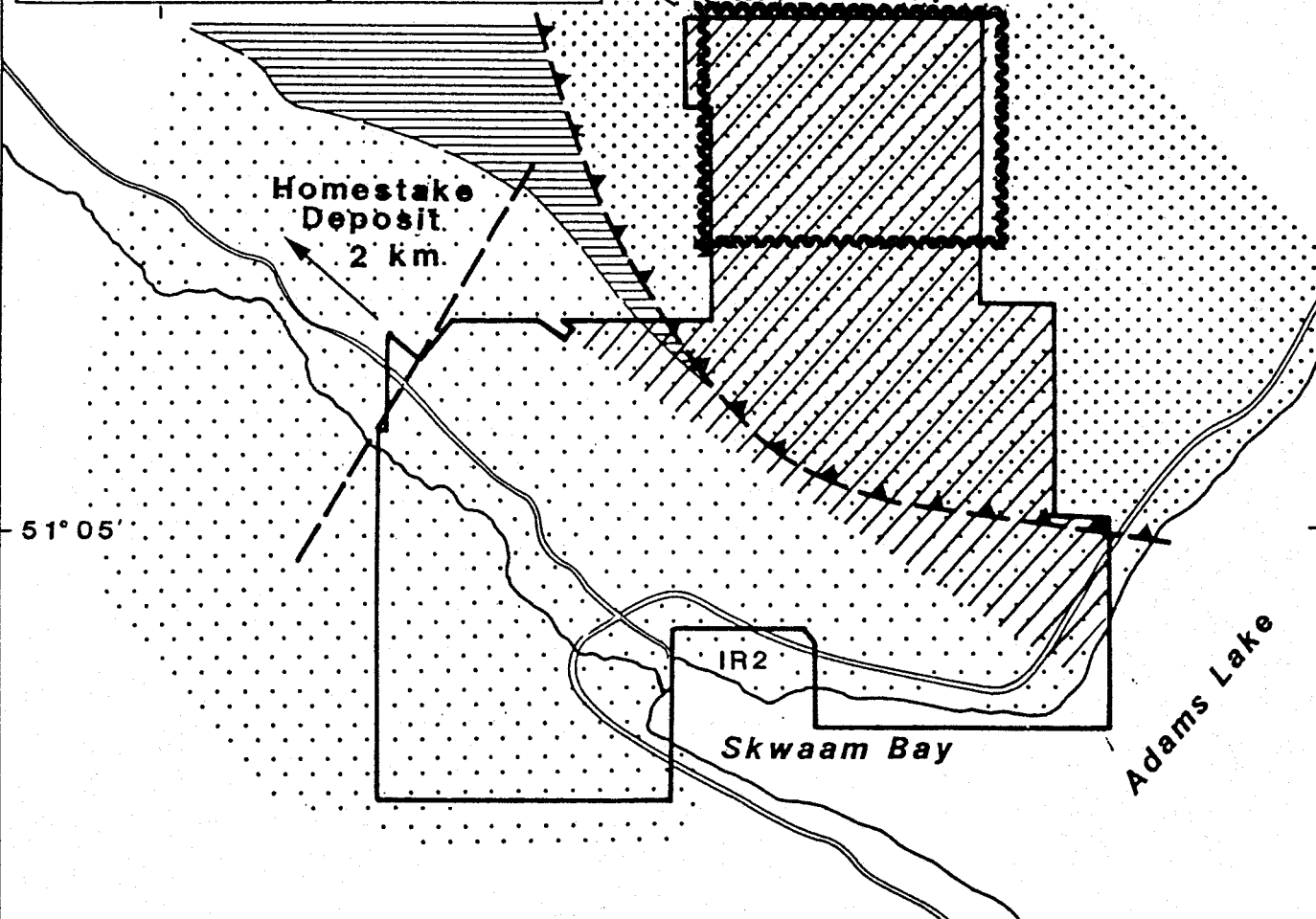
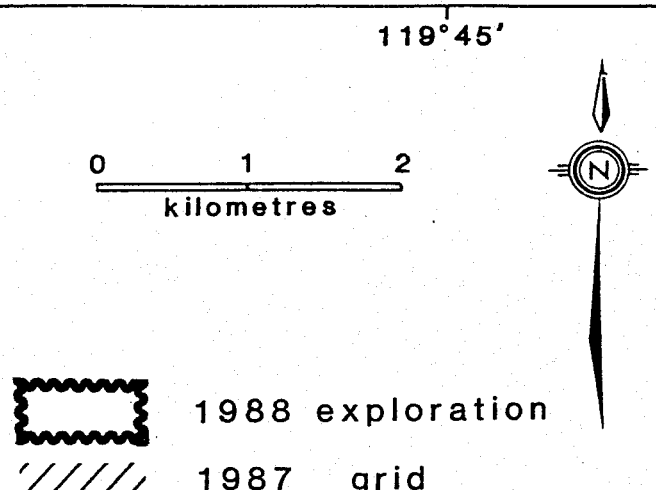
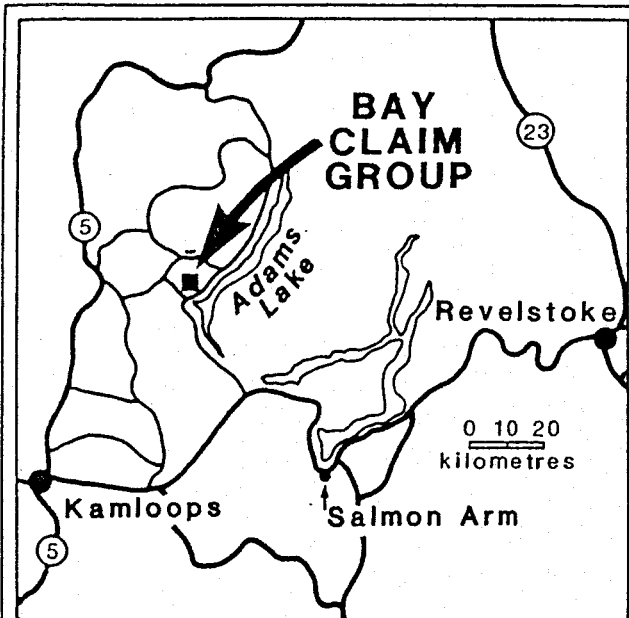
DEPOSITS/SHOWINGS

- ① BAY PROJECT
- ② HOMESTAKE
- ③ REA / SAMATOSUM
- ④ LUCKY COON
- ⑤ CHU CHUA
- ⑥ REXSPAR






KEY MAP

| | | |
|---|----------|-------------------|
| FALCONBRIDGE LIMITED | | |
| ADAMS PLATEAU | | |
| LOCATION MAP | | |
| PROJ. 144 | | |
| WORK BY | DRAWN BY | DATE |
| JB | VJG | May 1988 |
|  | | |
| 1 : 1,000,000 | | |
| | | Figure: 1. |



Eagle Bay Formation:

-  metasediments
-  mainly felsic metavolcanics
-  mainly mafic metavolcanics

Geology modified after Schiarizza and Preto (1984)

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BAY PROJECT (PN 144)

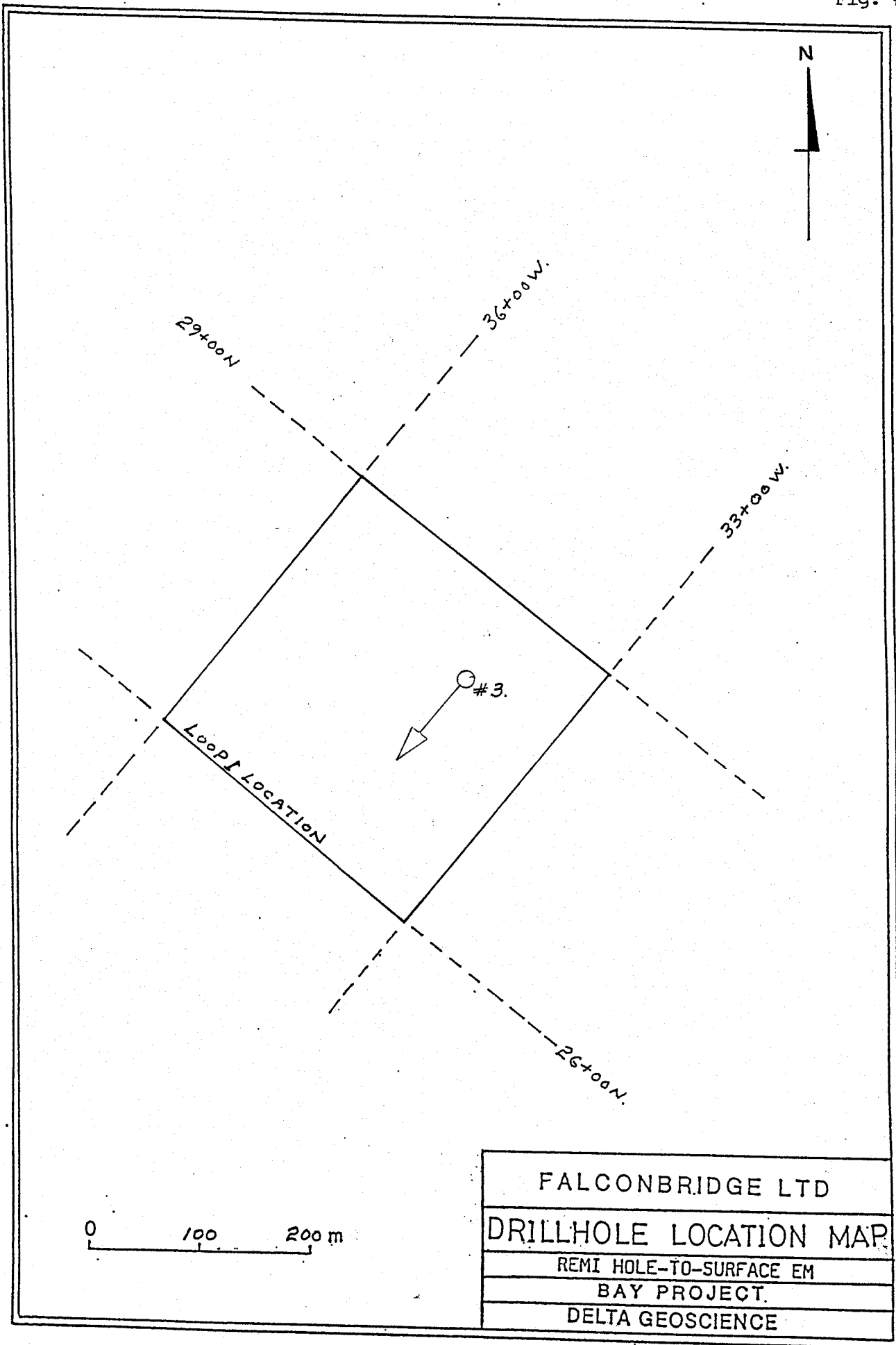
PROPERTY, GEOLOGY

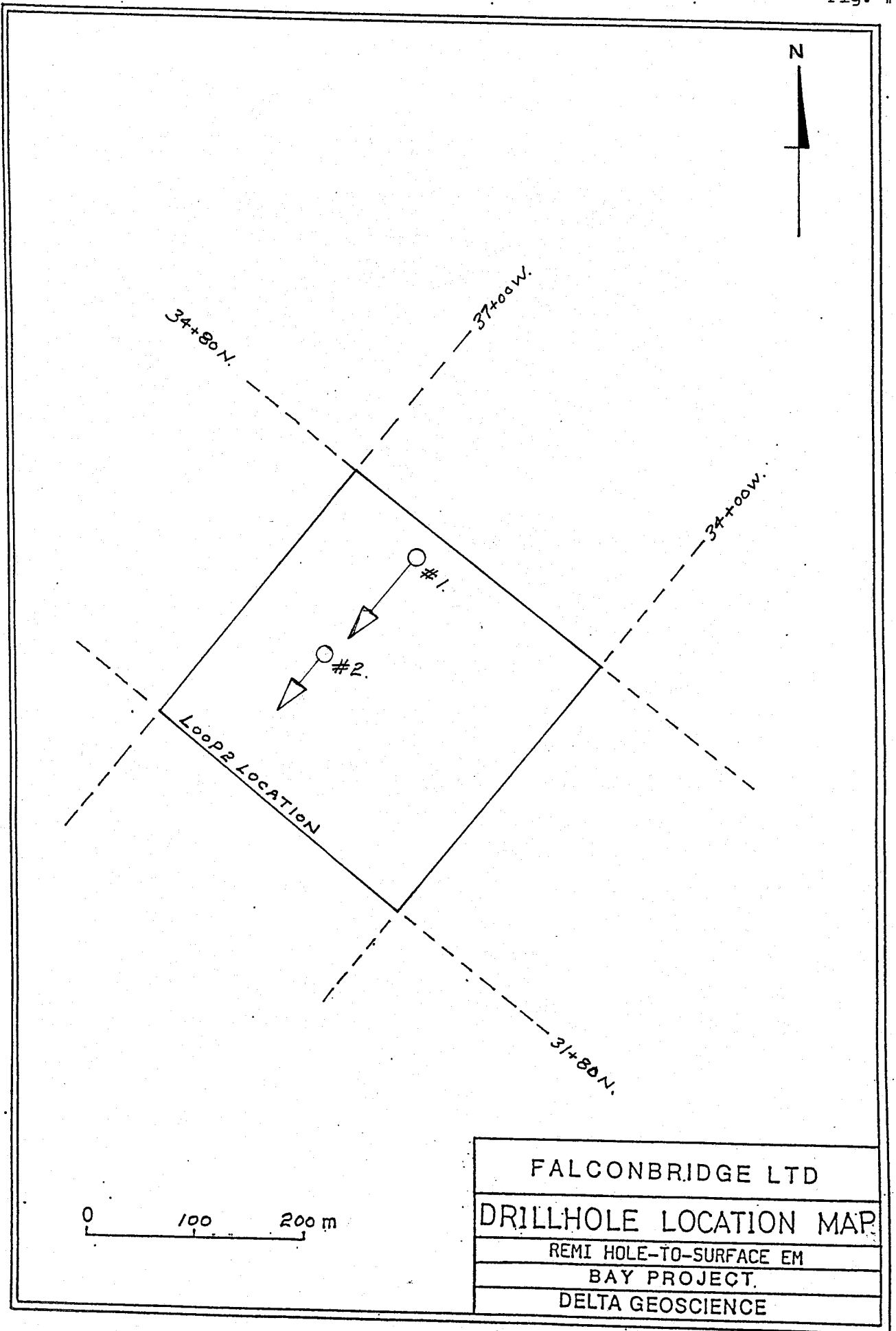
British Columbia
NTS: 82 M/4E

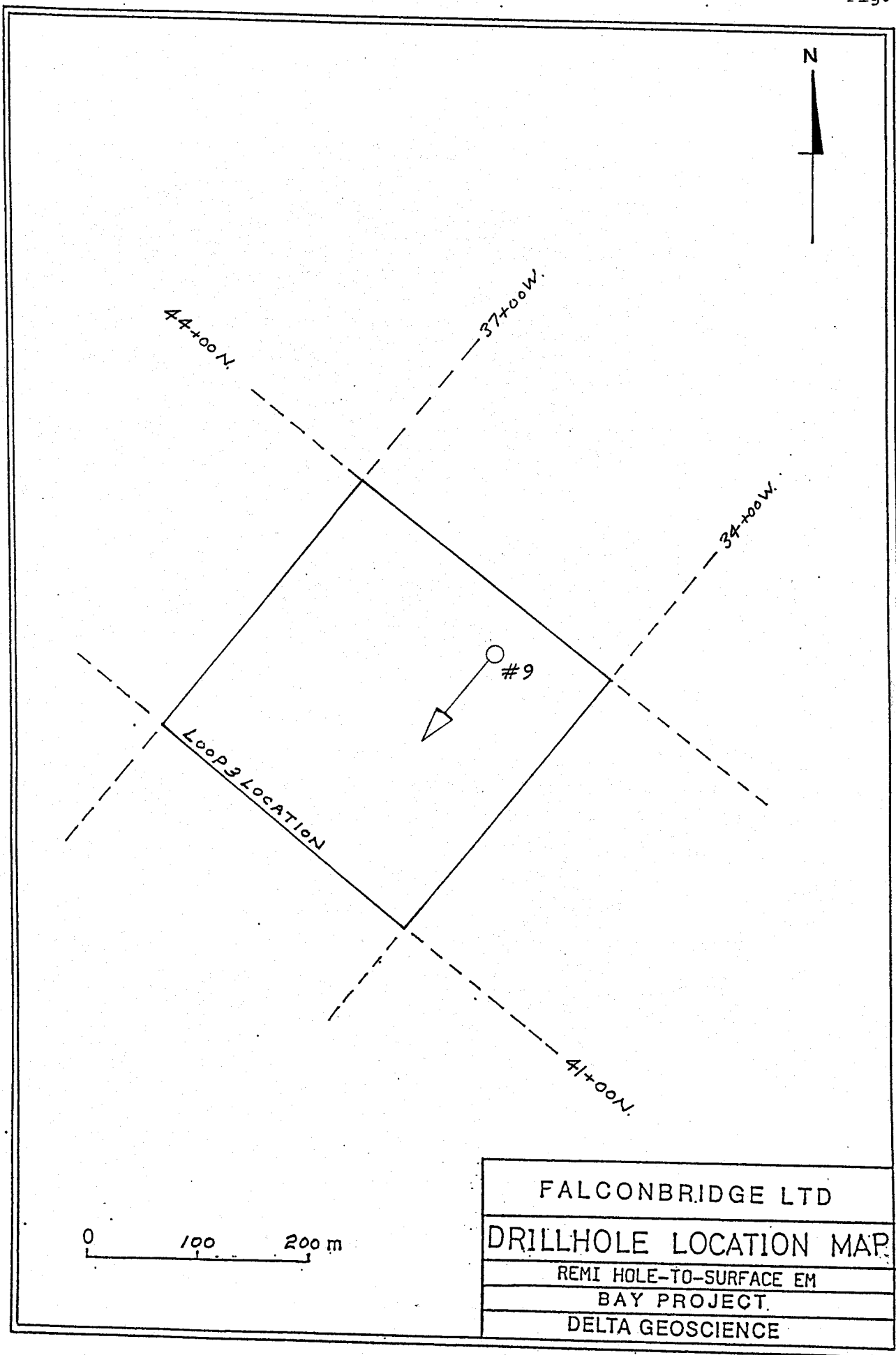
Date: June 1988

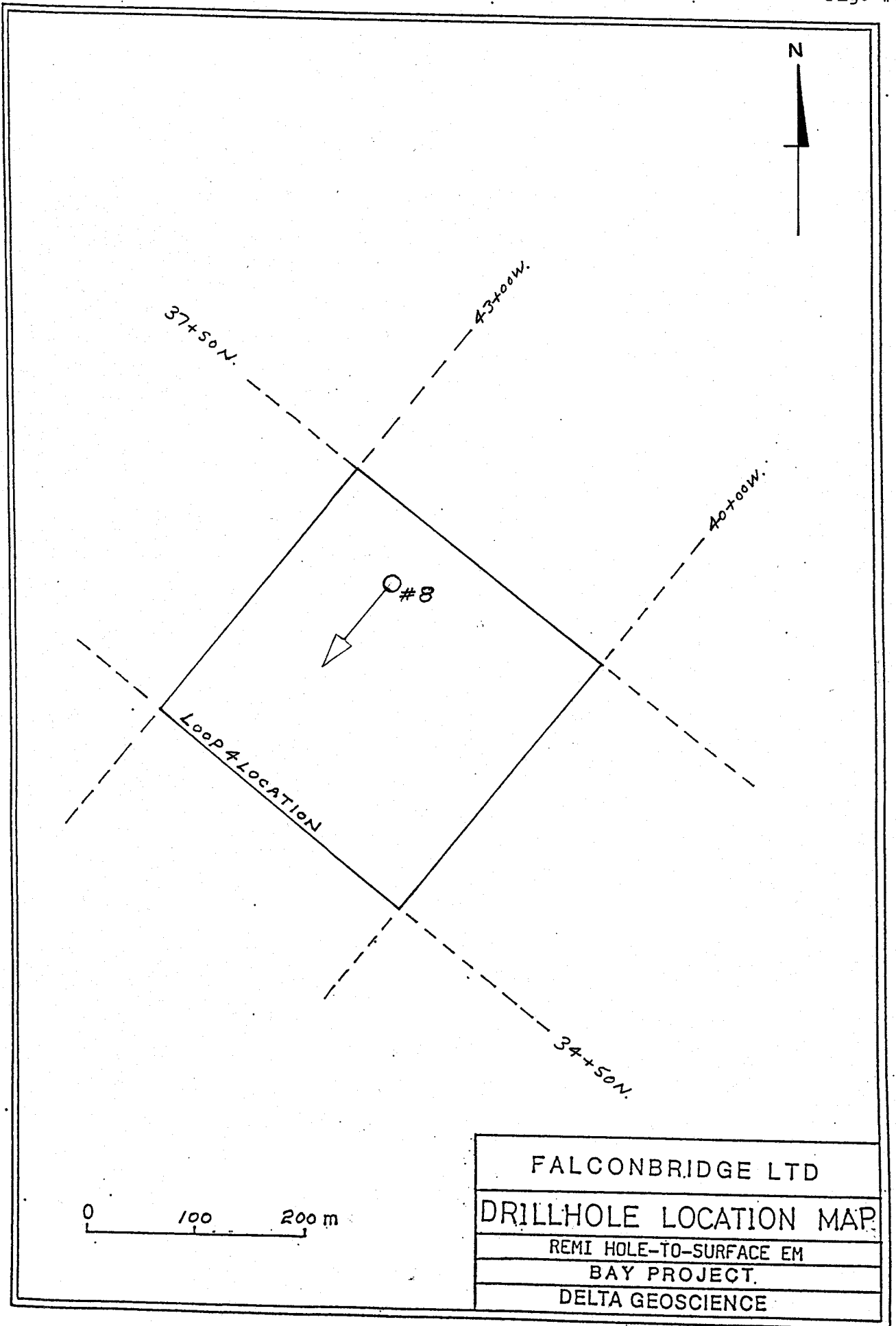
119° 50'

FIG.2.



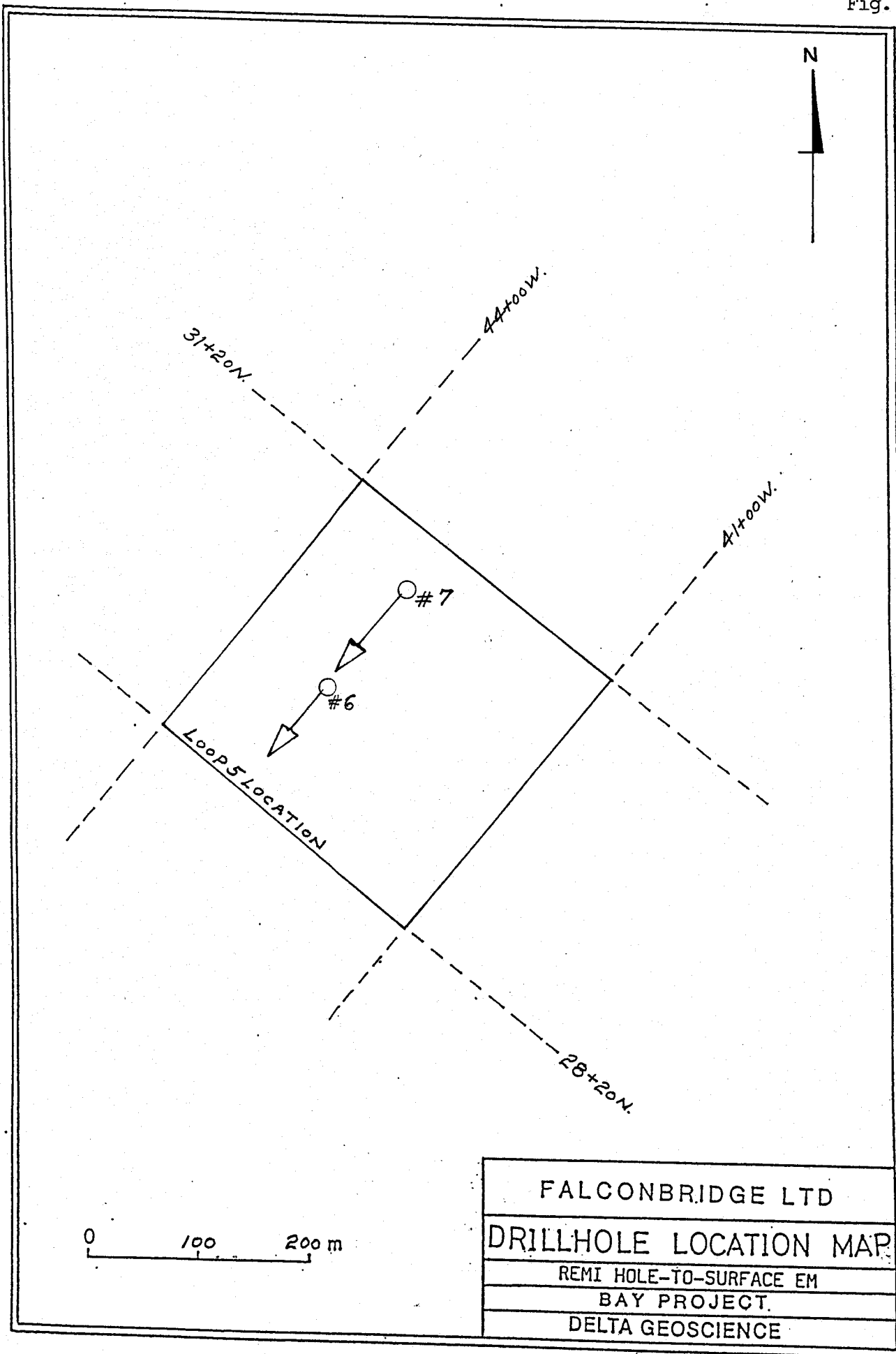


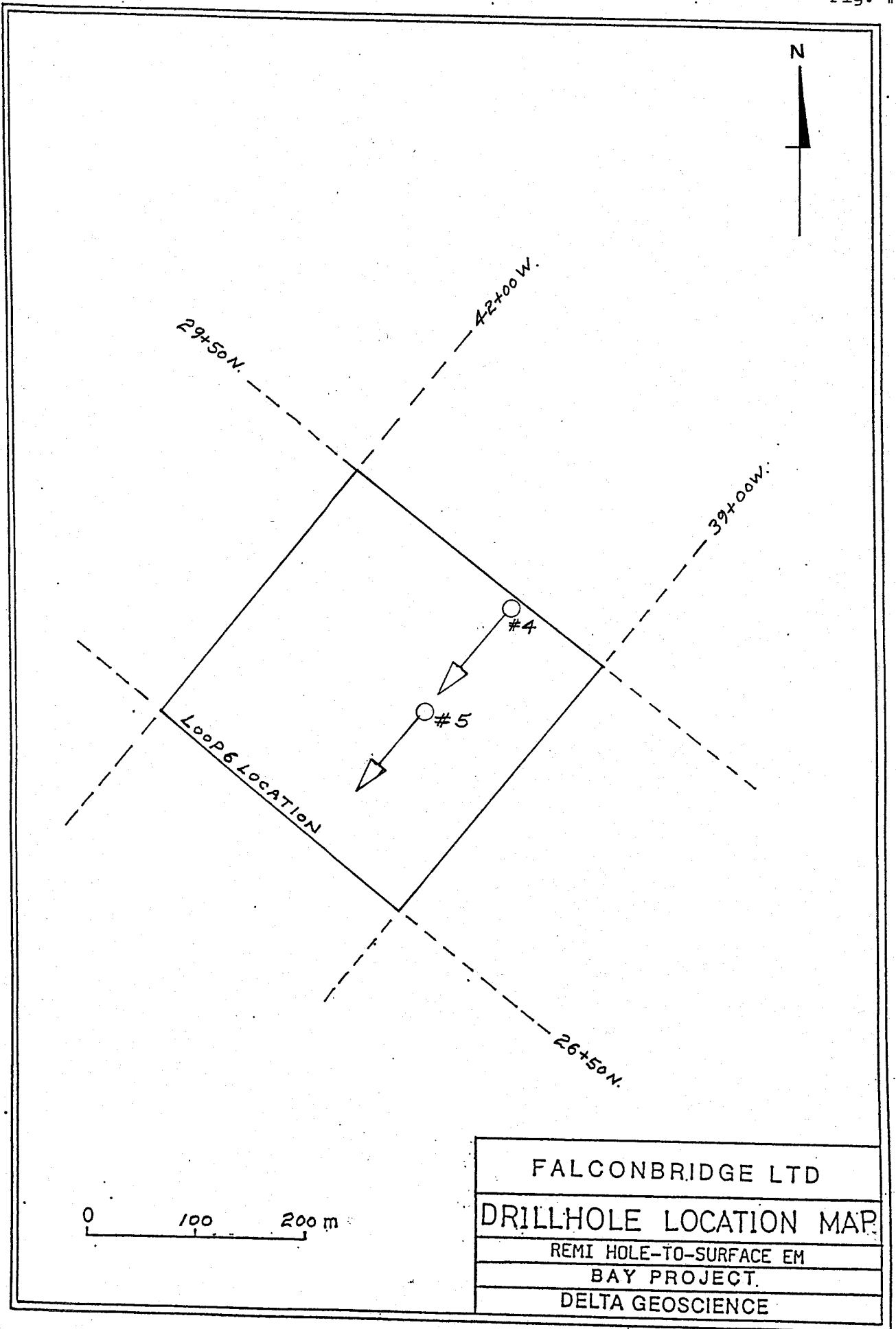




| |
|-------------------------|
| FALCONBRIDGE LTD |
| DRILLHOLE LOCATION MAP |
| REMI HOLE-TO-SURFACE EM |
| BAY PROJECT. |
| DELTA GEOSCIENCE |

Fig. #7.





0 100 200 m

| |
|--------------------------------|
| FALCONBRIDGE LTD |
| DRILLHOLE LOCATION MAP |
| REMEDIATION HOLE-TO-SURFACE EM |
| BAY PROJECT |
| DELTA GEOSCIENCE |

PERSONNEL

Scott Cosman - Geophysicist/Crew Chief
Tim Huttemann - Geophysicist
Grant Hendrickson - Senior Geophysicist/Supervisor

EQUIPMENT

- 1 - BRGM Melis Receiver: two channel frequency EM receiver (frequency range 0.12hz to 8000hz)., connected to the downhole and surface sensors.
- 1 - TX1000 BRGM Transmitter: frequency EM transmitter, 0.11hz to 7500hz, powered by a 220 volt, 60hz, 3.5kva Honda Motor Generator.
- 1 - Surface Loop: 1200m. electric wire with a total resistance of 8 ohms.
- 1 - Remi Borehole Probe: downhole CMS magnetic sensor, frequency range is 2hz to 8hz,, with a sensitivity of 50 mV/γ.
- 1 - Godek Winch Downhole System, with a 4 conductor armoured shield cable (610m).
- 1 - Sheave wheel assembly for depth in hole measurement, attaches to hole collar.
- 2 - King VHF Radios.
- 1 - 4x4 Toyota Truck.
- 1 - Toshiba 3100 Field Computer.
- 1 - Toshiba Printer.

DATA PRESENTATION

Data is presented as EM profiles of the borehole. Four profiles of each hole are presented as follows:

- a) in-phase/reference.
- b) out of phase/reference.
- c) amplitude/reference.

NOTE: $AMPLITUDE = \left[\left(\frac{I.P}{R} \right)^2 + \left(\frac{Q}{R} \right)^2 \right]^{1/2}$

- d) phase angle.

NOTE: Phase Angle = ARCTAN (Q/I.P) is in degrees.

Scales are presented on the profiles as the normalized electromagnetic response, versus depth in meters.

In addition, the phase angle data at the four frequencies is combined into one map of stacked phase angle profiles for each hole at 1:500 scale.

Drill hole location maps are provided showing the location of the surface loops and the boreholes.

LOOP LOCATION AND HOLE CO-ORDINATES

| <u>Hole Number</u> | <u>Co-ordinates</u> | | <u>Depth</u> |
|--------------------|---------------------|----------|--------------|
| BA89-1 | 34+54.ON | 36+04.8W | 162.71 |
| BA89-2 | 33+25.8N | 35+96.0W | 101.47 |
| BA89-3 | 28+10.1N | 34+00.0W | 147.52 |
| BA89-4 | 29+48.2N | 40+00.0W | 170.42 |
| BA89-5 | 28+10.8N | 39+99.0W | 99.97 |
| BA89-6 | 29+41.1N | 43+00.0W | 99.97 |
| BA89-7 | 30+65.8N | 42+99.0W | 175.87 |
| BA89-8 | 36+79.1N | 42+00.0W | 214.88 |
| BA89-9 | 43+57.4N | 35+00.0W | 160.63 |

Loop #1 co-ordinates: 29+00N, 26+00N, 33+00W, 36+00W.
DDH #3.

Loop #2 co-ordinates: 34+80N, 31+80N, 37+00W, 34+00W.
DDH #1, DDH #2.

Loop #3 co-ordinates: 44+00N, 41+00N, 34+00W, 37+00W.
DDH #9.

Loop #4 co-ordinates: 40+00W, 43+00W, 34+50N, 37+50N.
DDH #8.

Loop #5 co-ordinates: 44+00W, 41+00W, 31+20N, 28+20N.
DDH #6, DDH #7.

Loop #6 co-ordinates: 29+50N, 26+50N, 42+00W, 39+00W.
DDH #4, DDH #5.

SURVEY PROCEDURE

Surface loops 300m x 300m were laid out to encompass the drill holes. The spatial distribution of drill holes required six separate loop setups. All drill holes and their horizontal projection lie within their respective loops. The enclosed location maps illustrate the location of drill holes relative to their transmitting loops.

The reference sensor was set up approx. 10m. from each drill hole. This reference was fixed for the duration of the logging of that hole.

Holes were logged from the bottom to the top, in increments of 5 to 10 meters, depending on the detail desired. At each depth increment, four frequencies were transmitting in sequence: 90hz, 700hz, 1798hz and 3623hz. At each frequency the Melis receiver measured the in-phase (I.P) and out of phase(Q) components of the borehole axial field in amps/meter and the amplitude of the reference R also in amps/meter.

Note: That a full choice of frequencies from .1hz to 7500hz, with 10 frequencies per decade is available to the operator. This full frequency capability allows the geophysicist to design the survey to suit the range of conductivities expected for the mineralization and host rock, an important consideration in conductive terrains.

At the end of each day, the Melis receiver transferred the data to the Toshiba 3100, where the data was edited, normalized and plotted. This final step could easily be done on site if results were urgently needed.

DISCUSSION OF THE DATA

In-hole responses are indicated by positive deflections on the out-of-phase and phase profiles. If the conductor is strong enough, these deflections will be accompanied by negative deflections on the in-phase and amplitude profiles.

Off-hole responses are indicated by negative deflections on the out-of-phase and phase profiles. If the conductor is strong enough, these deflections will be accompanied by positive deflections on the in-phase and amplitude profiles.

The accompanying diagrams illustrate the in-hole and off-hole phase angle responses for a moderate and near conductor. The three degree phase response for a conductor off-hole 60 meters, although modest, is still 30 times the resolution ability of the REMI system.

The Melis receiver continuously monitors the electromagnetic noise in the hole and gives the operator two measurements of this noise: (a) standard deviation in %, and (b) quality factor in %. The quality coefficient depends on the noise observed at frequencies close to the analysis frequency; the standard deviation parameters depend on the noise observed at the frequency of the signal itself.

During the course of this survey, we were able to keep the standard deviation below 5% and the quality factor over 97% by continuously monitoring the noise at each frequency. Sometimes a longer stack was required to reduce the noise level. Resolution of the phase angle response is generally excellent (.1 degree).

The narrow, in-hole and off-hole conductors detected by this survey may be due to sulphide mineralization and/or thin graphitic horizons, possibly fault zones.

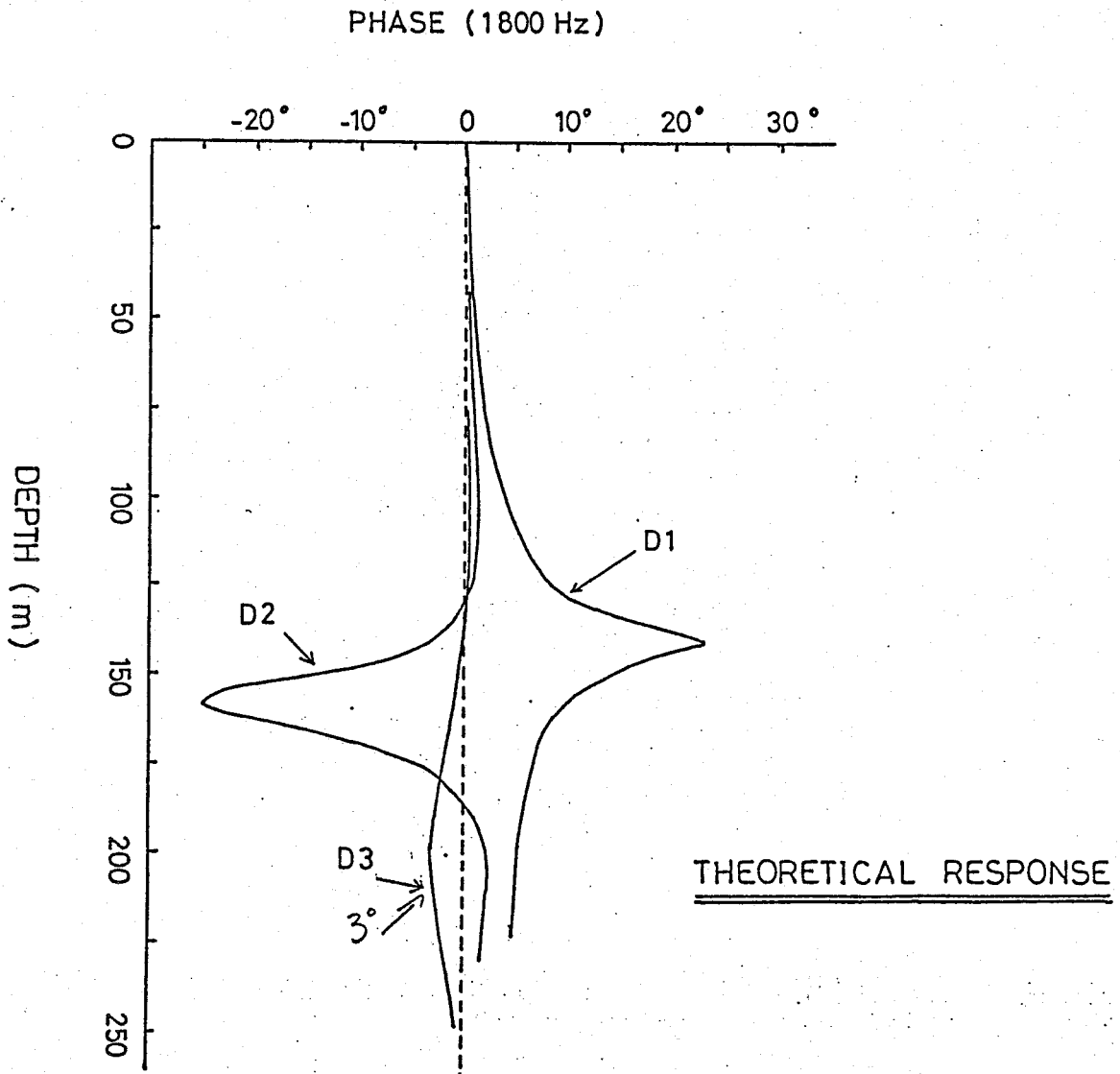
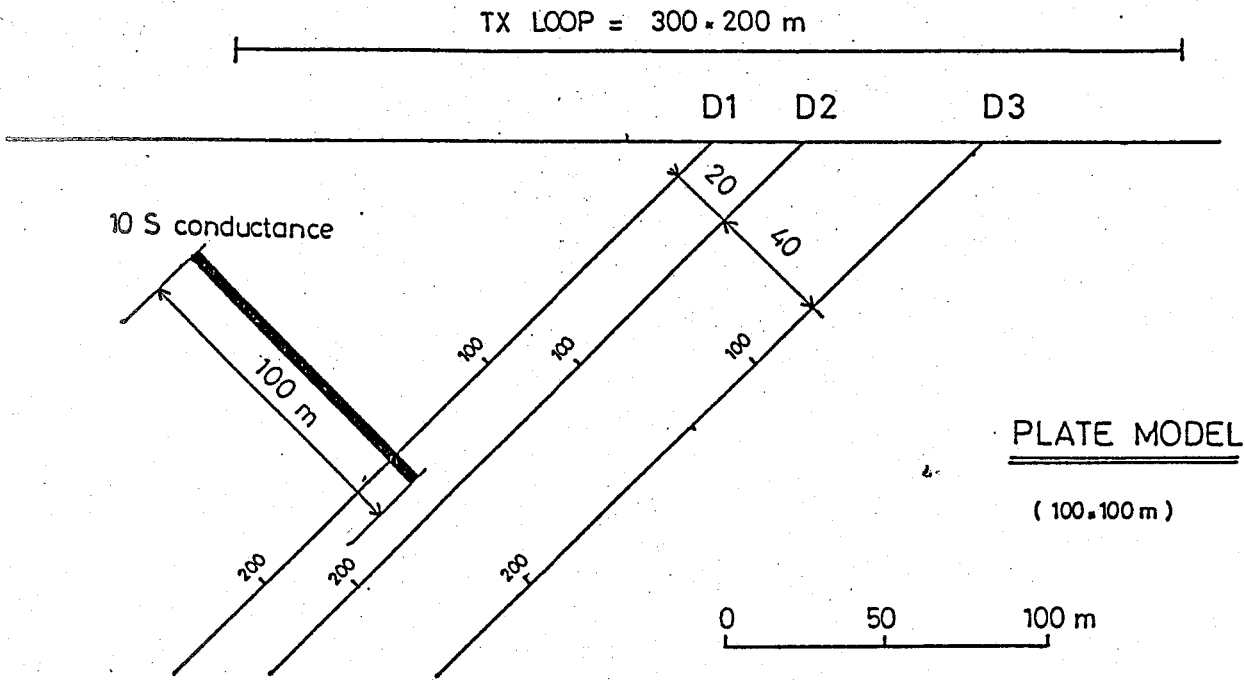
Broad, weak in-hole conductors are most likely due to carbonaceous argillite horizons. Another possibility is thin conductive horizons sub-parallel to the drill hole.

- DDH 1 - Narrow, weak off-hole response at 0+97m., is within 10m of the hole and has limited size.
- This hole passes below Hole 2.

- DDH 2 - Significant off-hole response at 0+45m likely within 15m. of the hole.
- Another significant off-hole response is starting to show up at the end of this show. The way the amplitude is building towards the bottom of the hole is very anomalous. This off-hole conductor most likely is 10 to 20 meters past the end of the hole. Since this hole is in section with DDH 1, the section should be studied closely to see if DDH 1 intersected the downdip area of this off-hole response.
- DDH 3 - Significant off-hole/in-hole edge type response occurs at 0+25m in an area mapped as deformed sericite schists.
- A modest narrow in-hole response occurs at 0+74m and is within 10m. of the hole and most likely downdip.
- DDH 4 - A significant off-hole response occurs at 1+35m approx. 30m. from the hole and most likely up dip.
- Some minor weak in-hole conductivity is noted in the first 50m. of this hole.
- DDH 5 - Weak, in-hole response at 0+25m.
- Weak, off-hole response at 0+65m approx. 20m from the hole and most likely downdip.
- DDH 6 - Weak, off-hole response at 0+57m within 10m. of the hole.
- Another weak, off-hole response is starting to show up at the end of the hole at approx. 1+00m, again quite close to the hole.
- DDH 7 - Weak, broad in-hole responses occur at 0+72m and 1+15m, neither of which appear very significant.
- DDH 8 - Modest in-hole response at 0+80m is likely due to a fair conductor of limited size.
- Off-hole response at 1+50m, again is likely due to a fair conductor of limited size approx. 5m from the hole. The symmetrical nature of this response suggests this hole is at right angles to the zone.

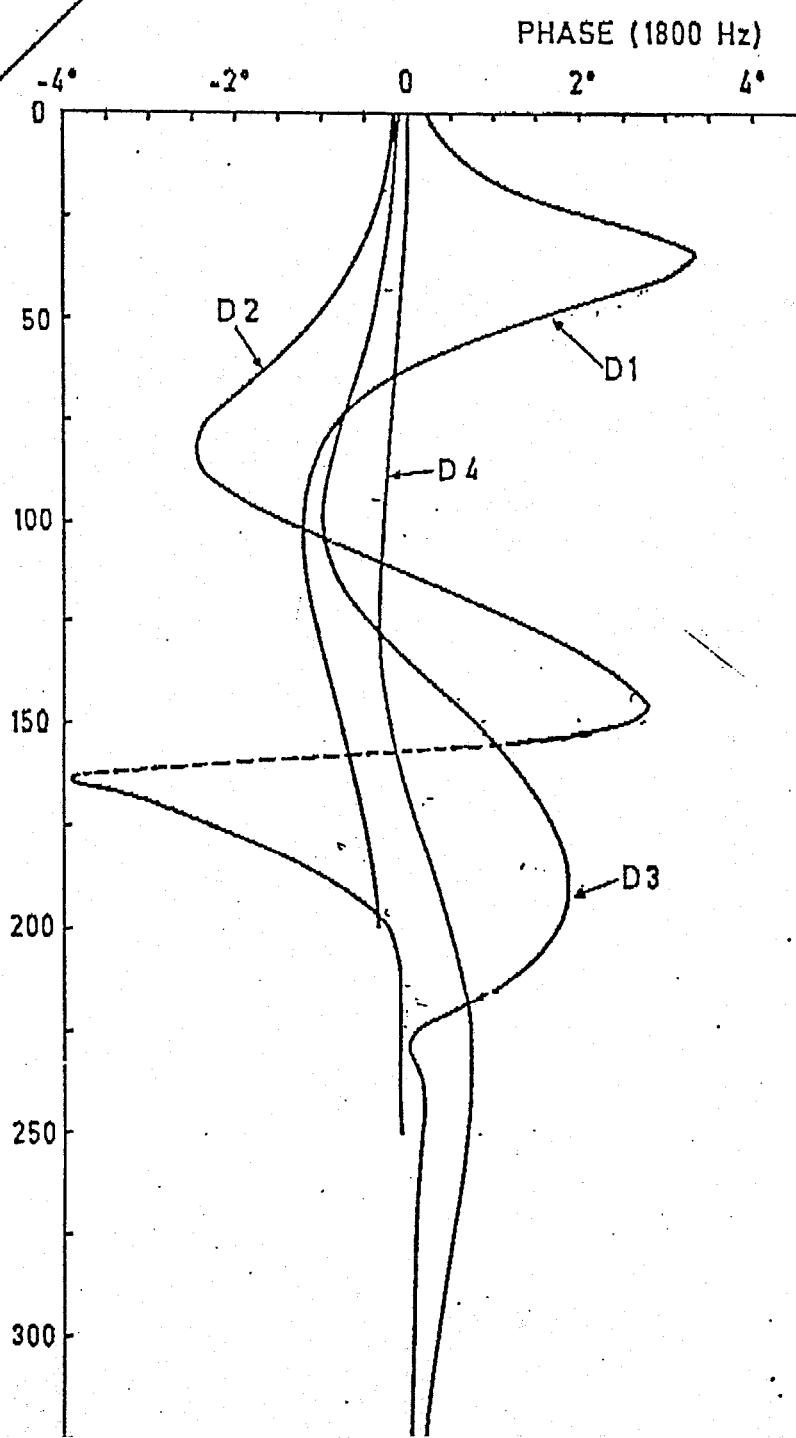
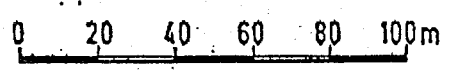
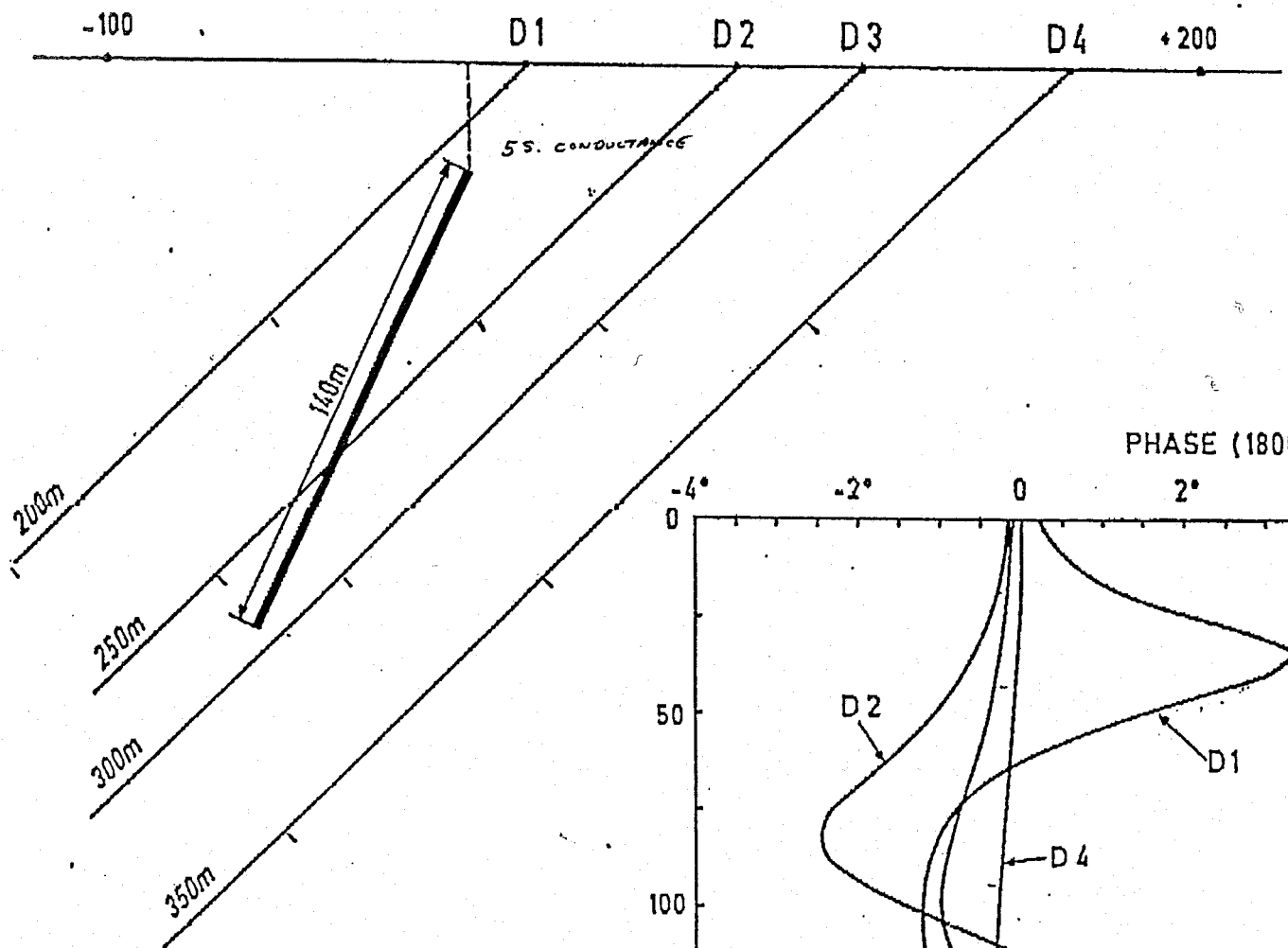
- DDH 9 - Significant off-hole response very close to the surface at 0+10m. The geology for the first part of the hole should be checked carefully. Conductor appears to be approx. 20m from the hole, however it's difficult to judge since this response occurs so close to the surface. Possible casing effect cannot be ruled out.
- Off-hole response at 1+50m is modest yet significant. Again this conductive zone is close to the hole (15-20m), however without the whole wavelength (zone is at the end of the hole), it's difficult to evaluate.

Fig. #9.



TX LOOP = 300 x 300

PLATE MODEL IN FREE-AIR




CONCLUSIONS AND RECOMMENDATIONS

Correlating these borehole EM results with the detailed geology of each hole is essential to fully understand the significance of off-hole and in-hole responses recorded by the Remi system.

Most of the weak responses are likely due to argillite horizons.

Off-hole responses created by conductors a long way from the hole have a long, low amplitude wavelength that at times is difficult to separate accurately from the background response of the hole, particularly for relatively short holes.

The off-hole response indicated at the end of Hole #2 is significant and deserves careful consideration.



Grant A. Hendrickson, P.Geoph.

REFERENCES

Bernard, J., January 1988: Test of Remi Hole to Surface Electromagnetic Equipment at Chemainus, B.C., Canada. B.R.G.M. Report.

B.R.G.M. Report, September 1988: Operating Procedures of Remi Hole to Surface Frequency EM Method.

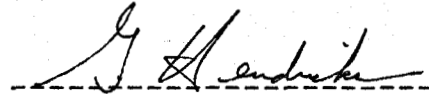
Borehole Geophysics for Mining and Geotechnical Applications, Geological Survey of Canada Paper 85-27. Edited by P.G. Killeen, 1986.

STATEMENT OF QUALIFICATION

Grant A. Hendrickson

- B.Science, U.B.C. 1971, Geophysics option.
- For the past 18 years, I have been actively involved in mineral exploration projects throughout Canada, the United States, Europe and Central and South America.
- I am a registered Professional Geophysicist with the Association of Professional Engineers, Geologists and Geophysicists of Alberta.
- I am an active member of the S.E.G., E.A.E.G., and B.C.G.S.

Dated at Delta, British Columbia, this 4 day of
SEPT, 1989.



Grant A. Hendrickson, P.Geoph.

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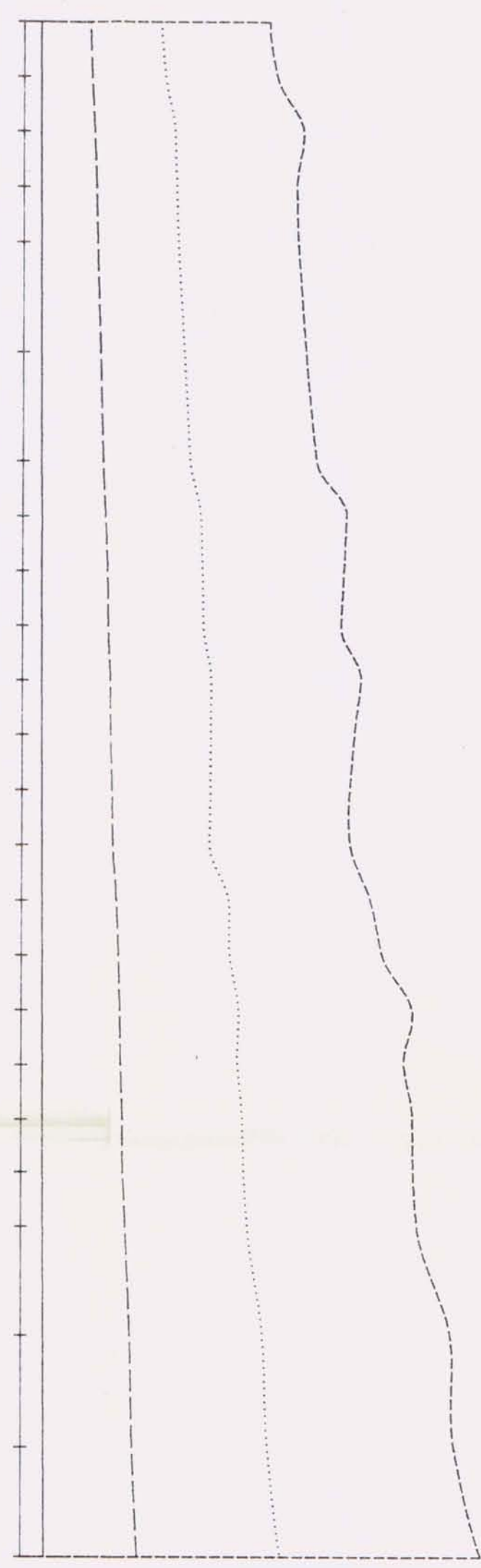
-50

-100

-150

-200

-250



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BAY PROJECT, ADAMS PLATEAU
 BAY GRID, DDH 1
 BOREHOLE ELECTROMAGNETIC SURVEY
 PHASE ANGLE PROFILES, (1 cm = 5 deg)

90 hz solid line, 700 hz long dashes
 1800 hz dotted line, 3620 hz short dashes
 SCALE 1:500

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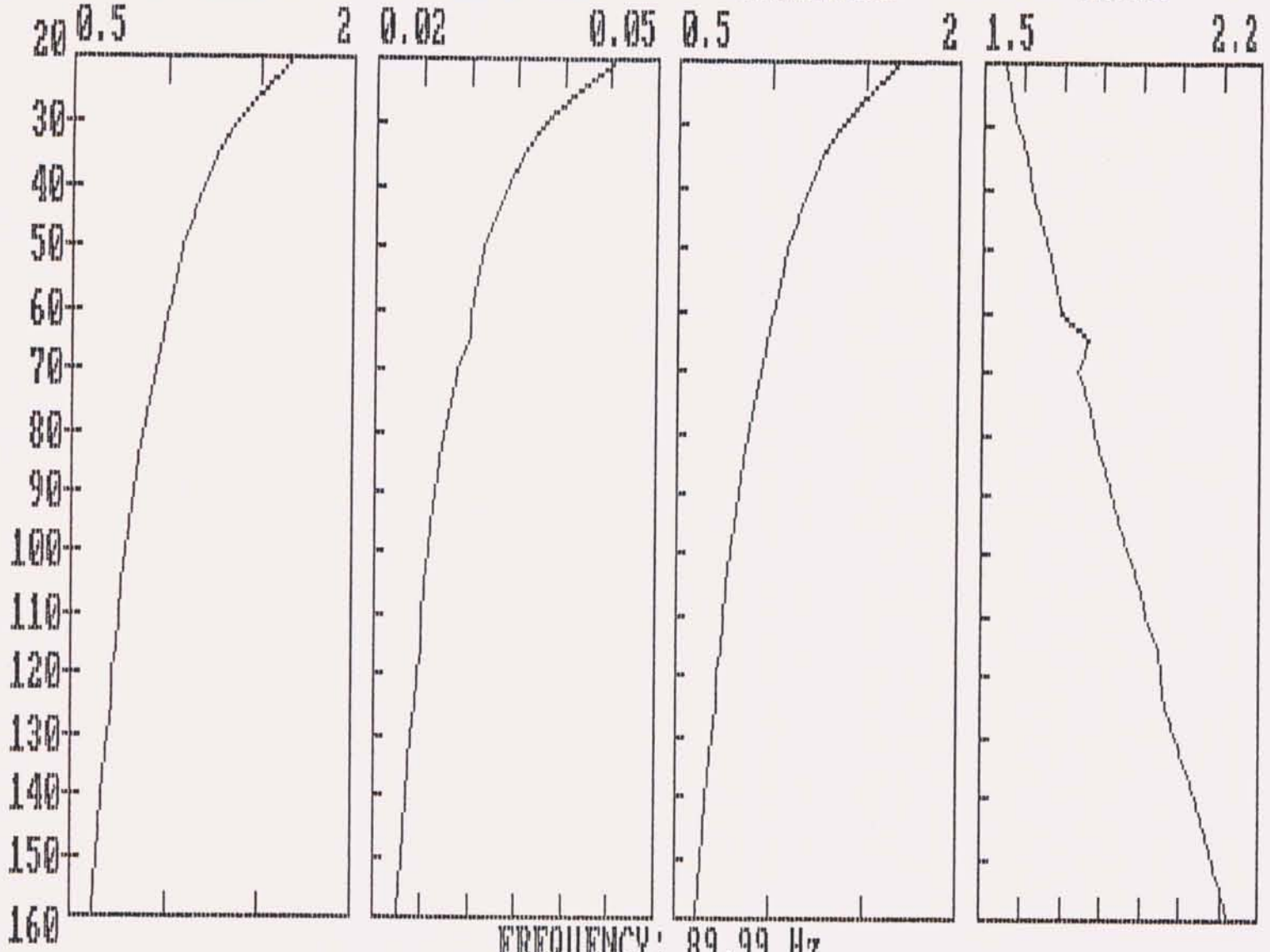
BARRIERE DDH 1 EM LOG

IN PHASE

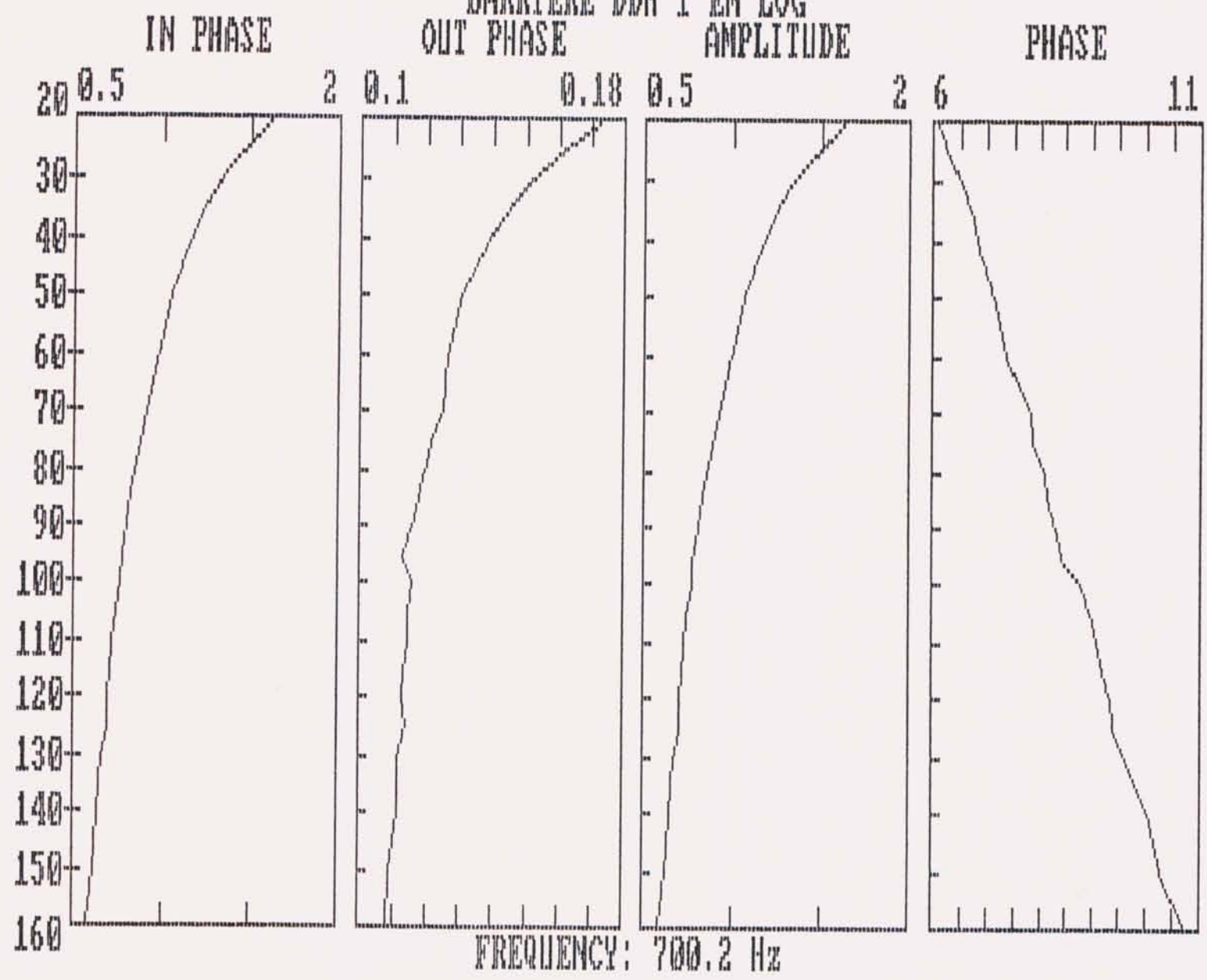
OUT PHASE

AMPLITUDE

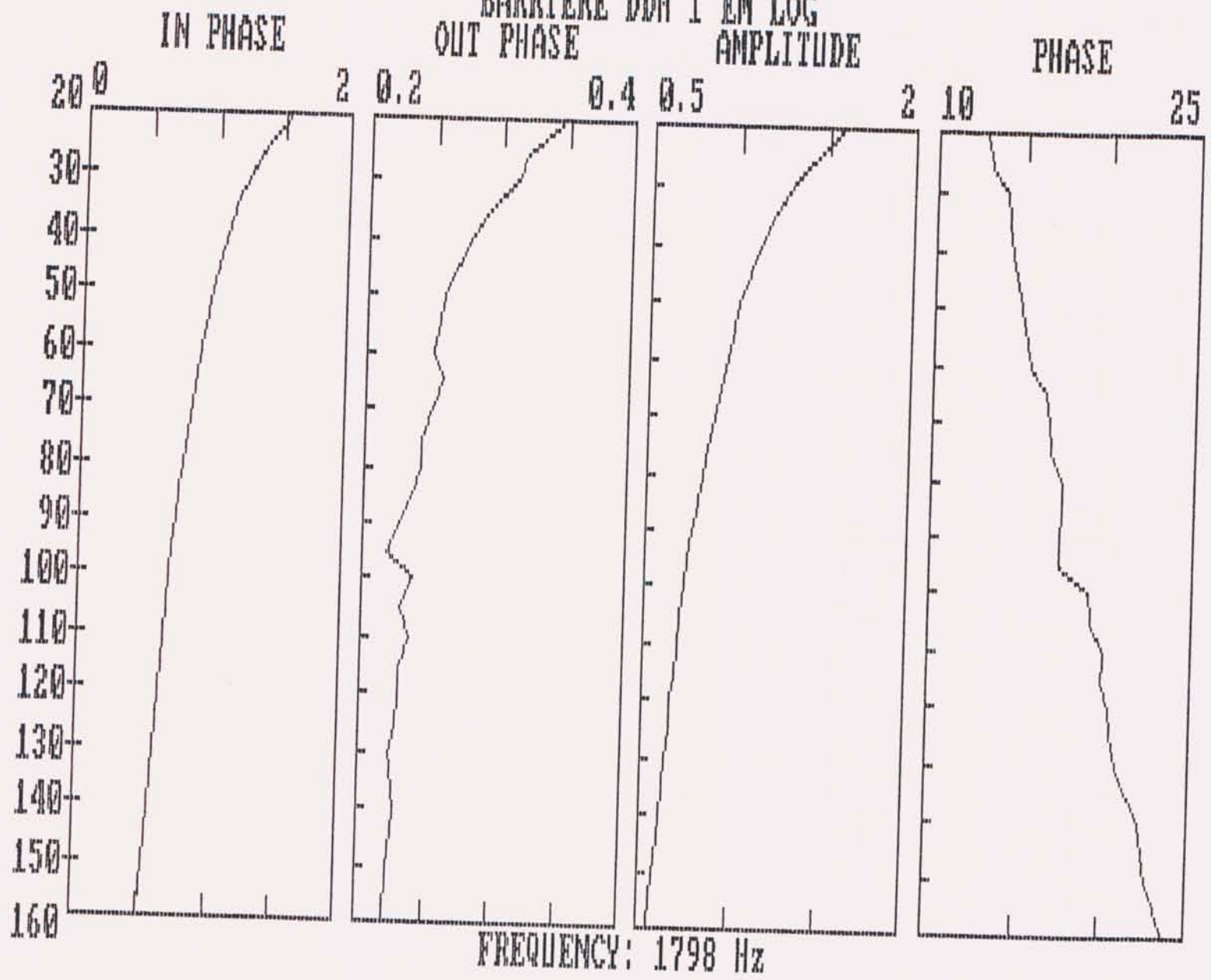
PHASE



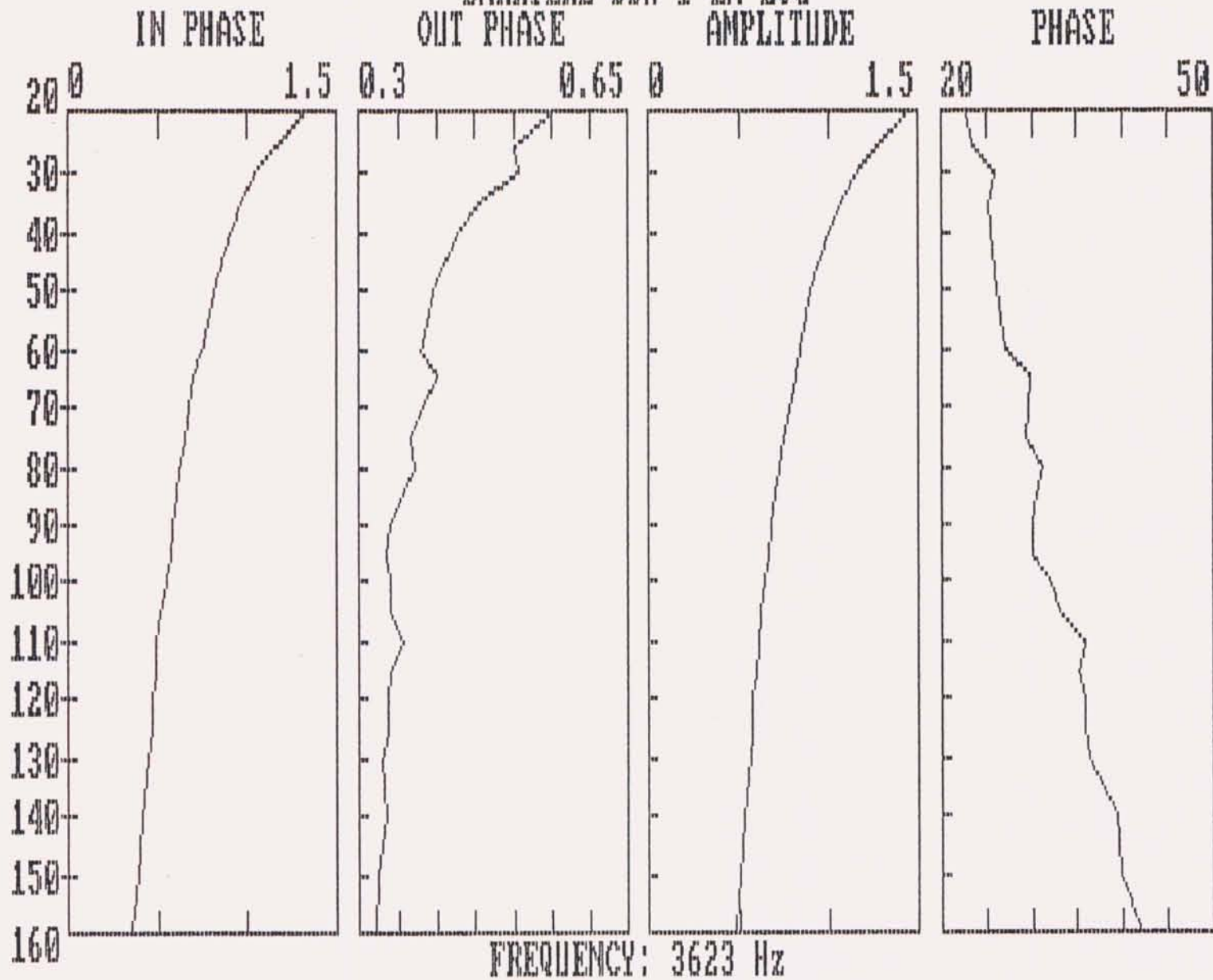
BARRIERE DDH 1 EM LOG
AMPLITUDE

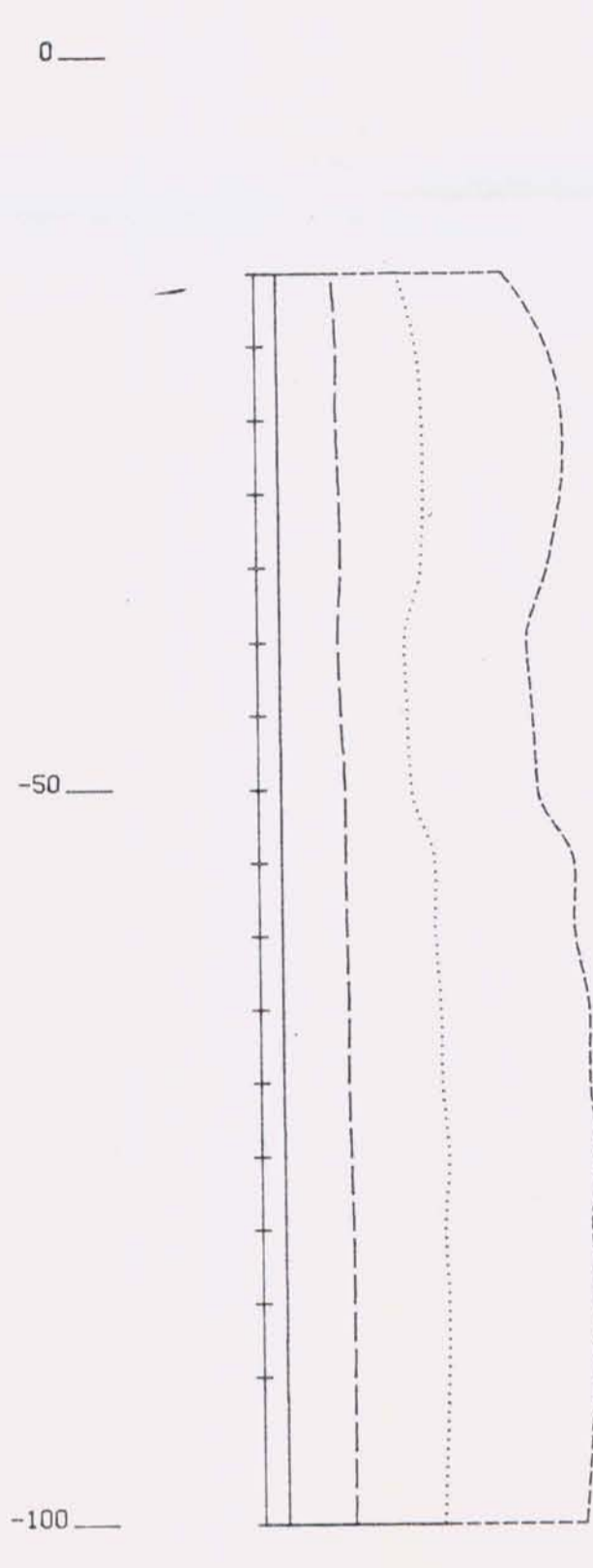


BARRIERE DDH 1 EM LOG
OUT PHASE AMPLITUDE



BARRIER DDH 1 EM LOG
OUT PHASE





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BAY PROJECT, ADAMS PLATEAU
 BAY GRID, DDH 2
 BOREHOLE ELECTROMAGNETIC SURVEY
 PHASE ANGLE PROFILES, (1 cm = 5 deg)

90 hz solid line, 700 hz long dashes
 1800 hz dotted line, 3620 hz short dashes
 SCALE 1:500

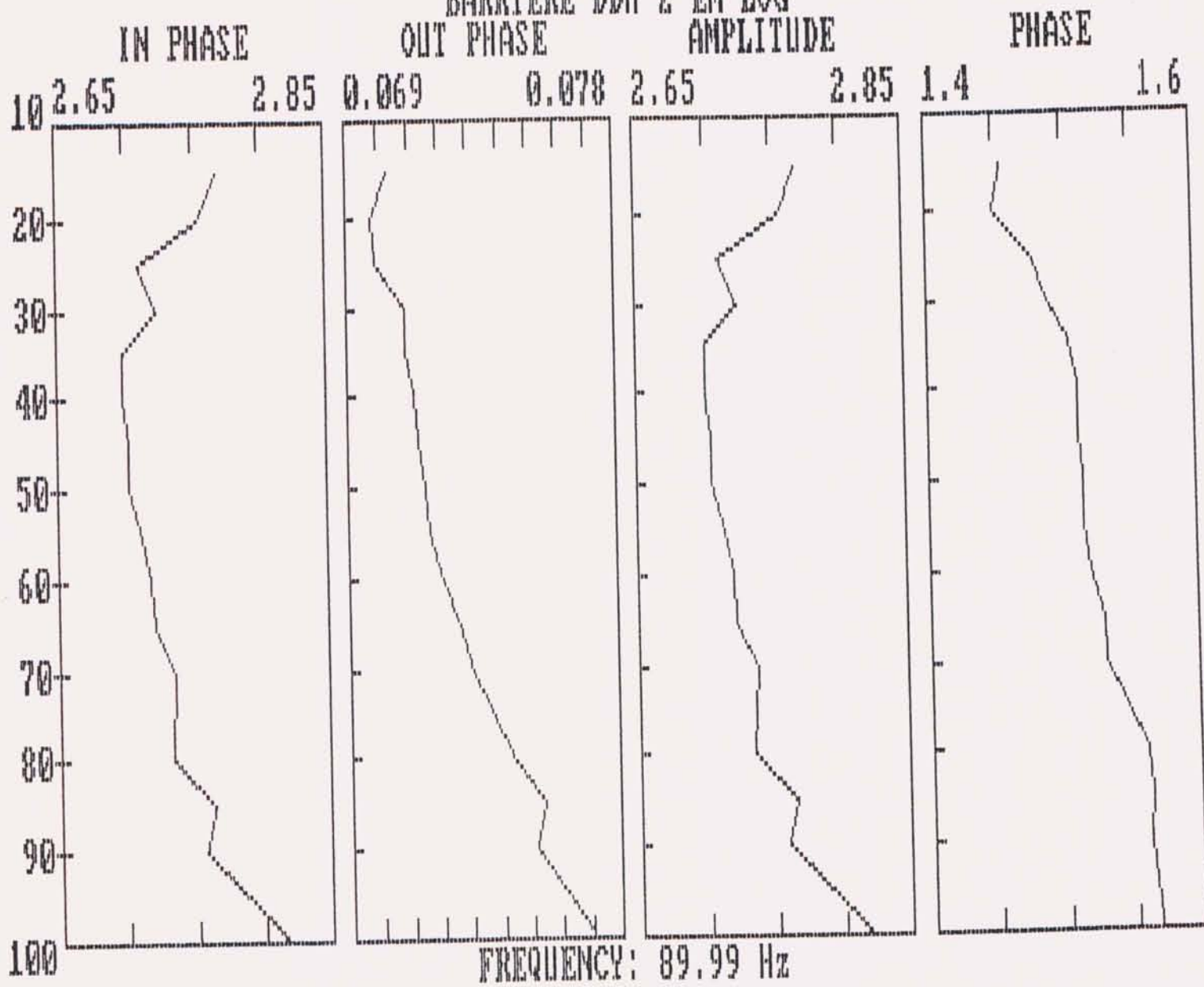
DELTA GEOSCIENCE LTD

-150

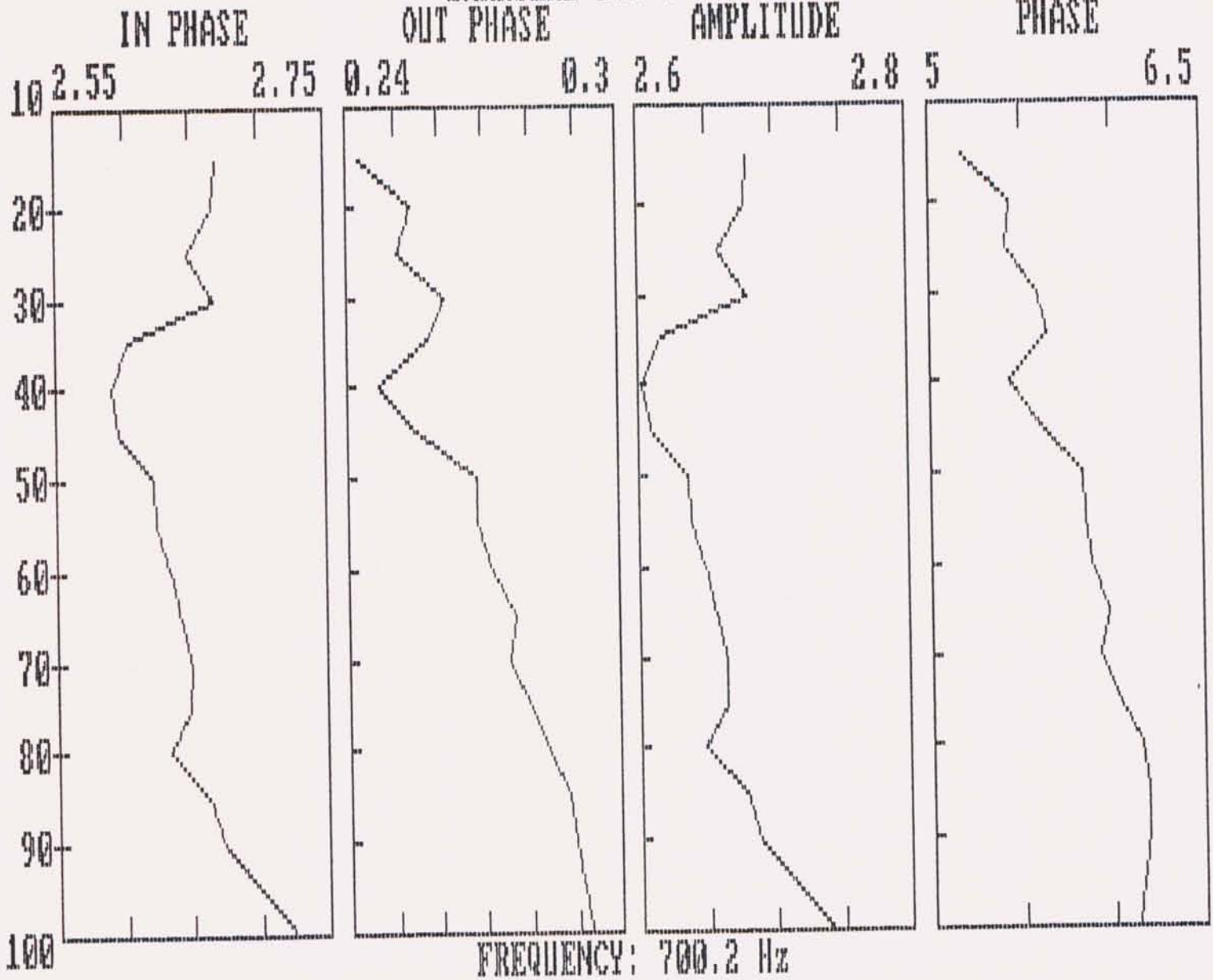
-200

-250

BARRIERE DDH 2 EM LOG
OUT PHASE AMPLITUDE



BARRIERE DDH 2 EM LOG
OUT PHASE AMPLITUDE



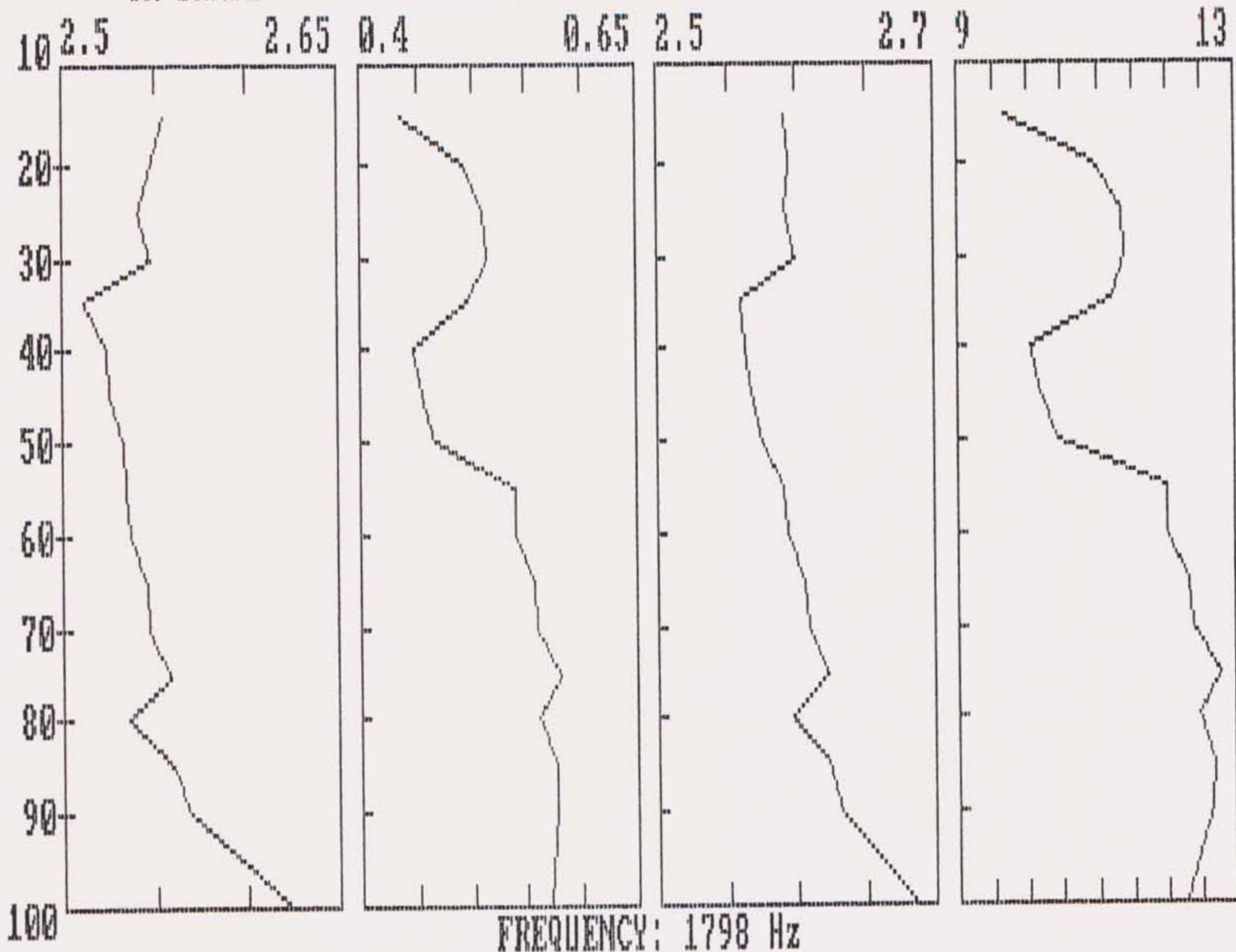
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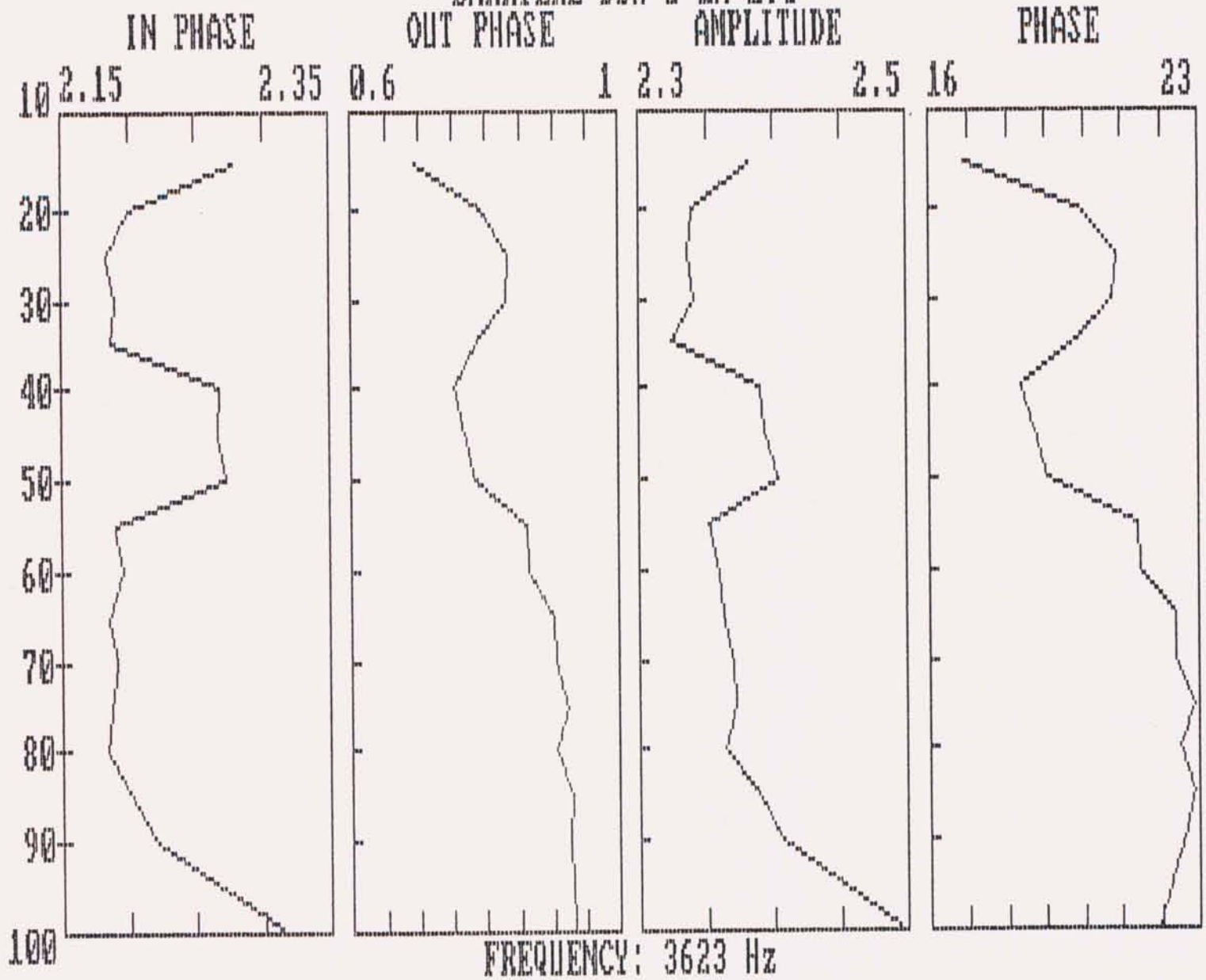
OUT PHASE

AMPLITUDE

PHASE



BARRIERE DDH 2 EM LOG
OUT PHASE AMPLITUDE



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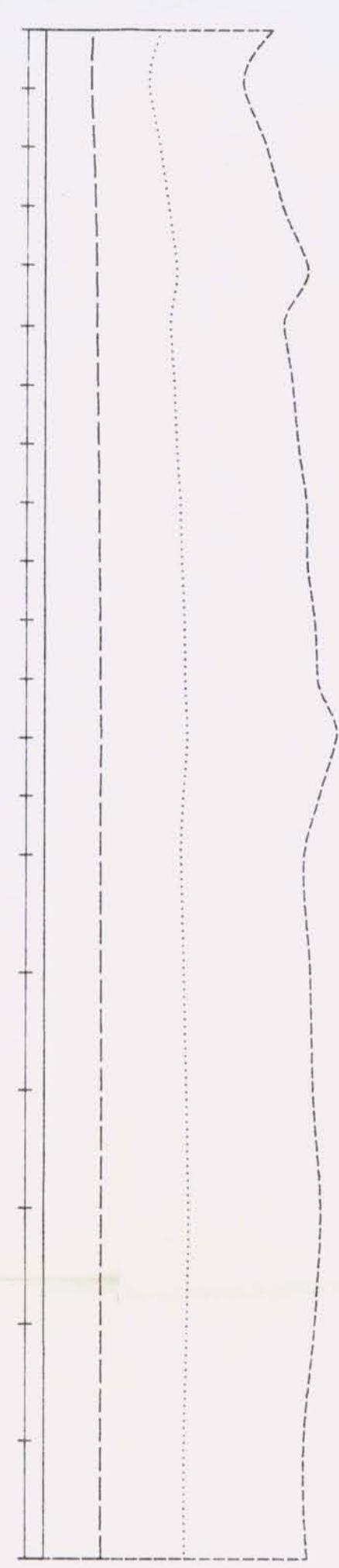
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BAY PROJECT, ADAMS PLATEAU
 BAY GRID, DDH 3
 BOREHOLE ELECTROMAGNETIC SURVEY
 PHASE ANGLE PROFILES, (1 cm = 5 deg)

90 hz solid line, 700 hz long dashes
 1800 hz dotted line, 3620 hz short dashes
 SCALE 1:500

DELTA GEOSCIENCE LTD

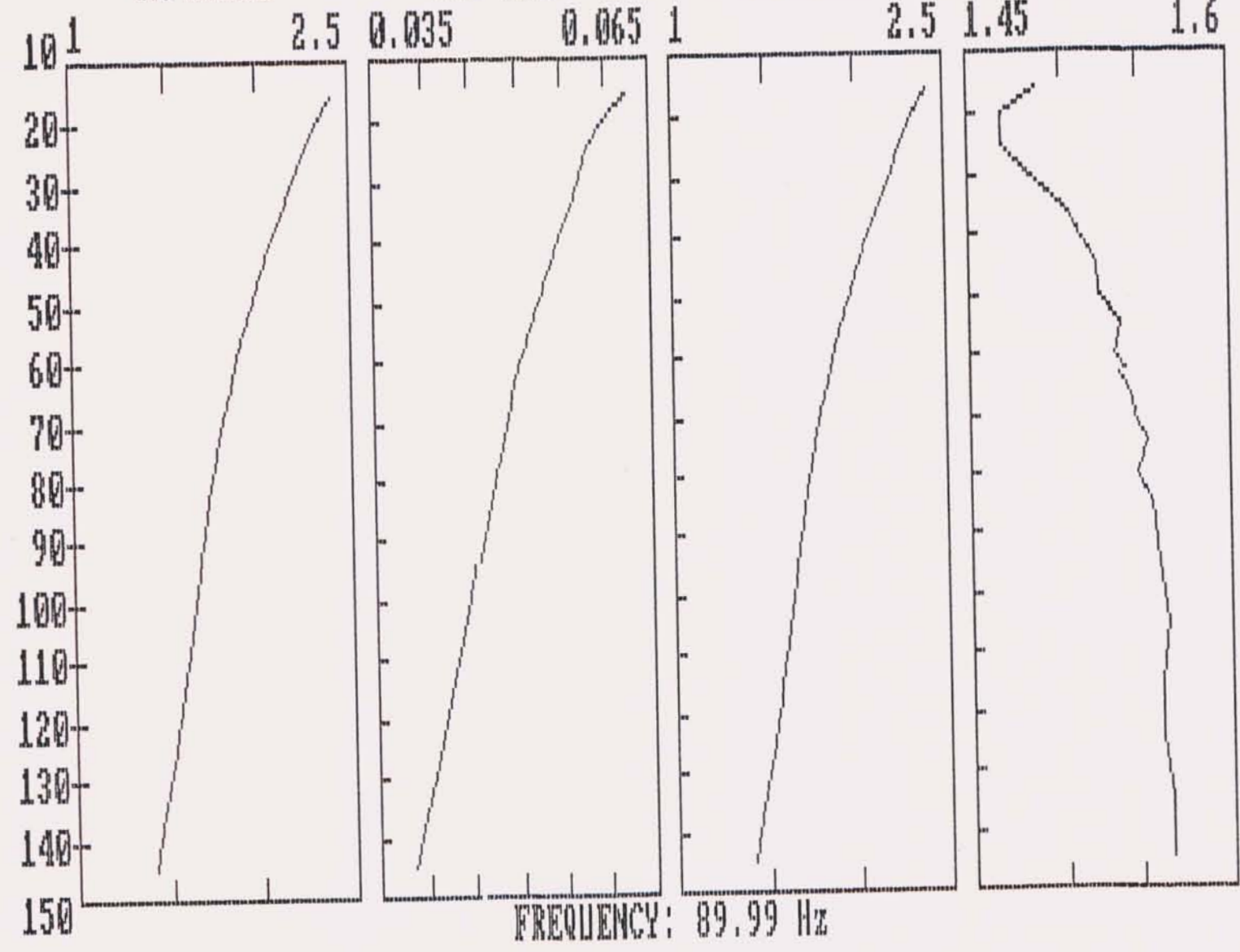
BARRIERE DDH 3 EM LOG

IN PHASE

OUT PHASE

AMPLITUDE

PHASE



BARRIERE DDH 3 EM LOG

IN PHASE

OUT PHASE

AMPLITUDE

PHASE



FREQUENCY: 700.2 Hz

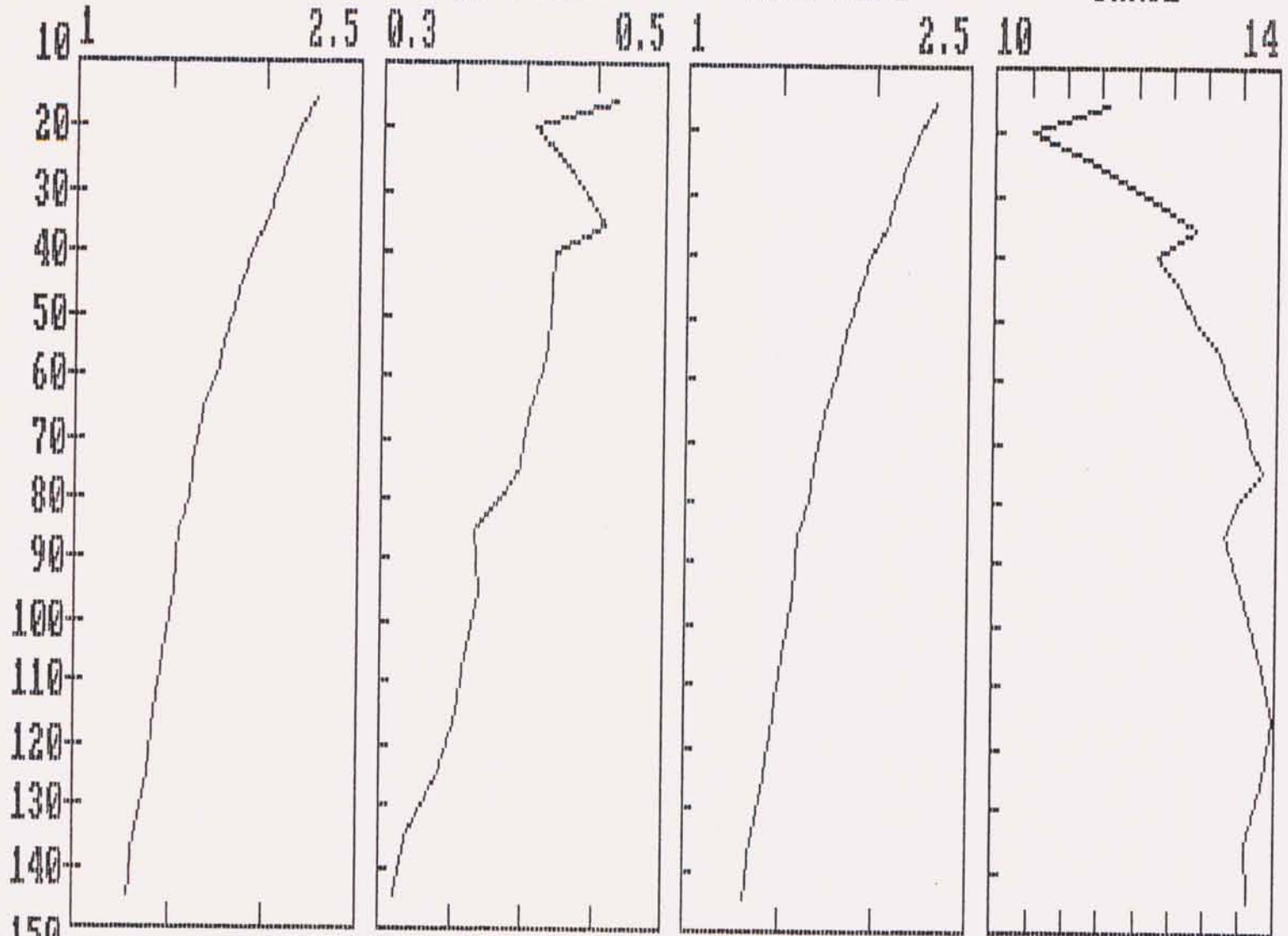
BARRIERE DDH 3 EM LOG

IN PHASE

OUT PHASE

AMPLITUDE

PHASE

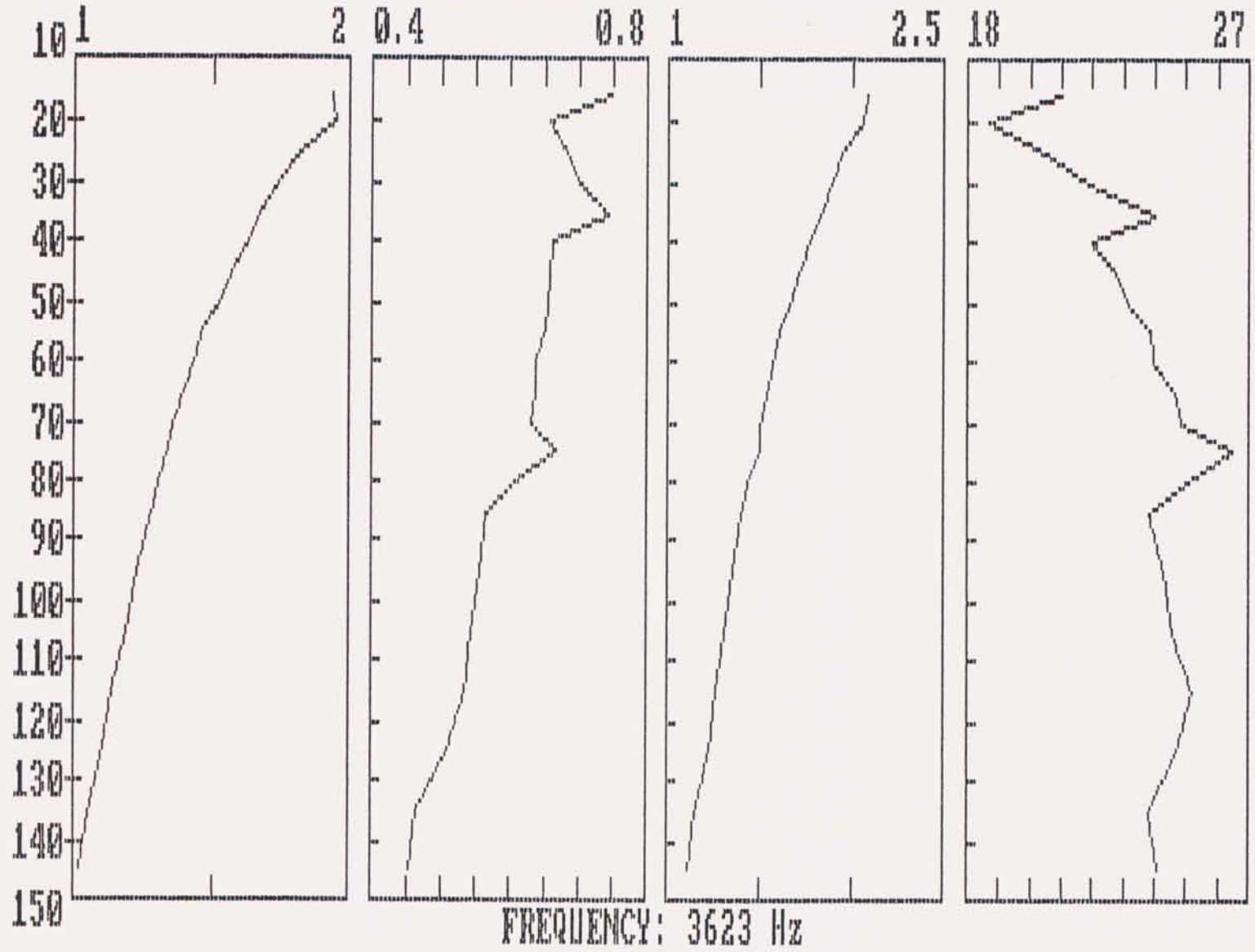


FREQUENCY: 1798 Hz

BARRIERE DDH 3 EM LOG
OUT PHASE AMPLITUDE

IN PHASE

PHASE



0

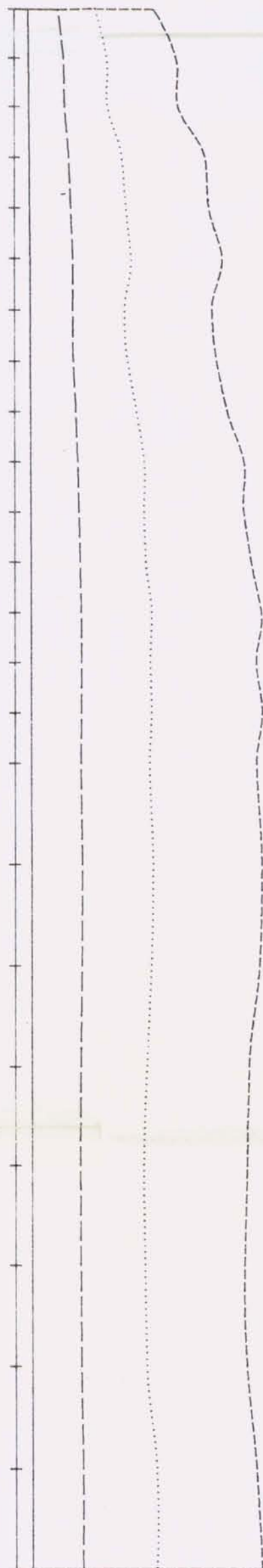
-50

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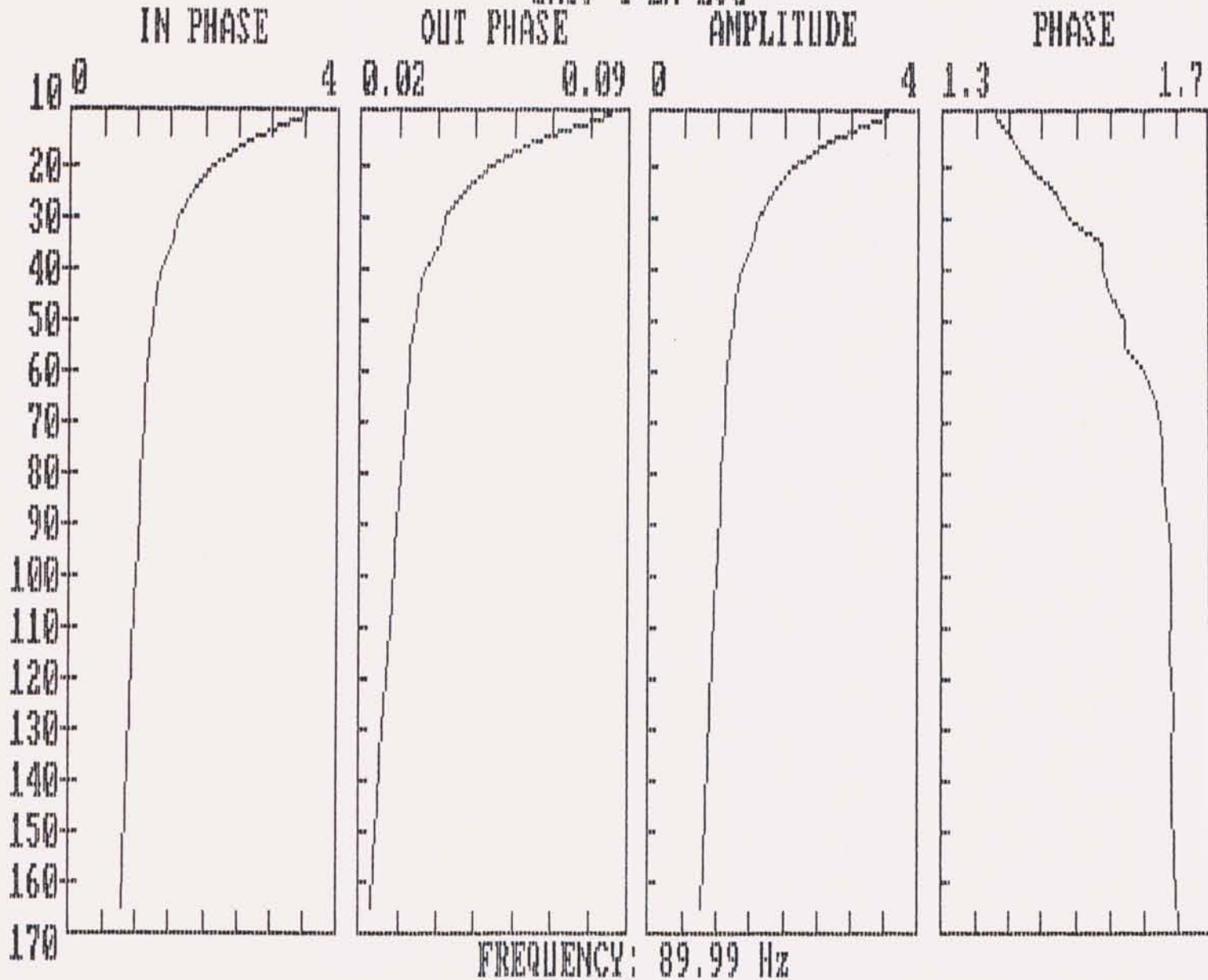
FALCONBRIDGE LTD

BAY PROJECT, ADAMS PLATEAU
 BAY GRID, DDH 4
 BOREHOLE ELECTROMAGNETIC SURVEY
 PHASE ANGLE PROFILES, (1 cm = 5 deg)

90 hz solid line, 700 hz long dashes
 1800 hz dotted line, 3620 hz short dashes
 SCALE 1:500

DELTA GEOSCIENCE LTD

BAB9-4 EM LOG



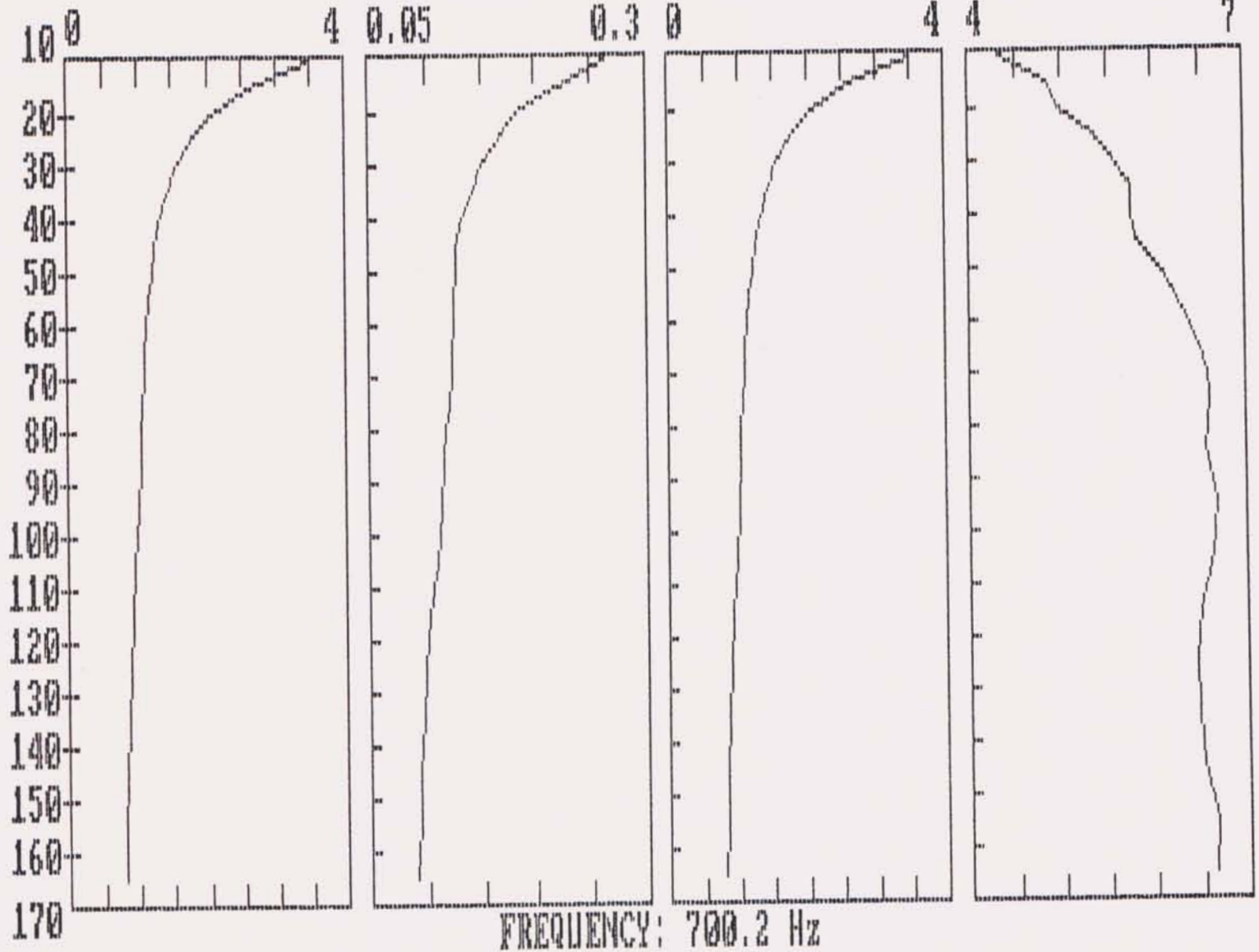
BAB9-4 EM LOG

IN PHASE

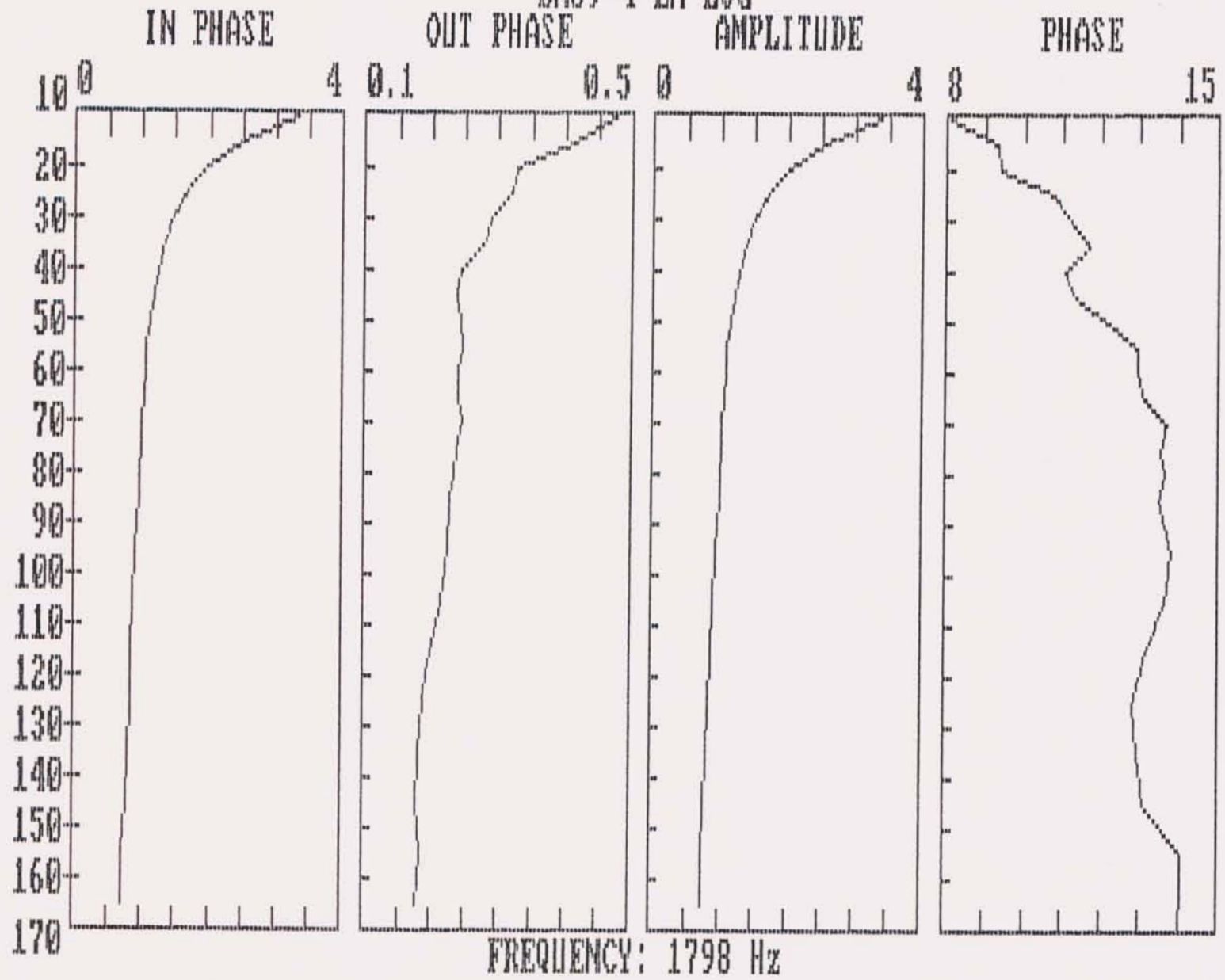
OUT PHASE

AMPLITUDE

PHASE



BAB9-4 EM LOG



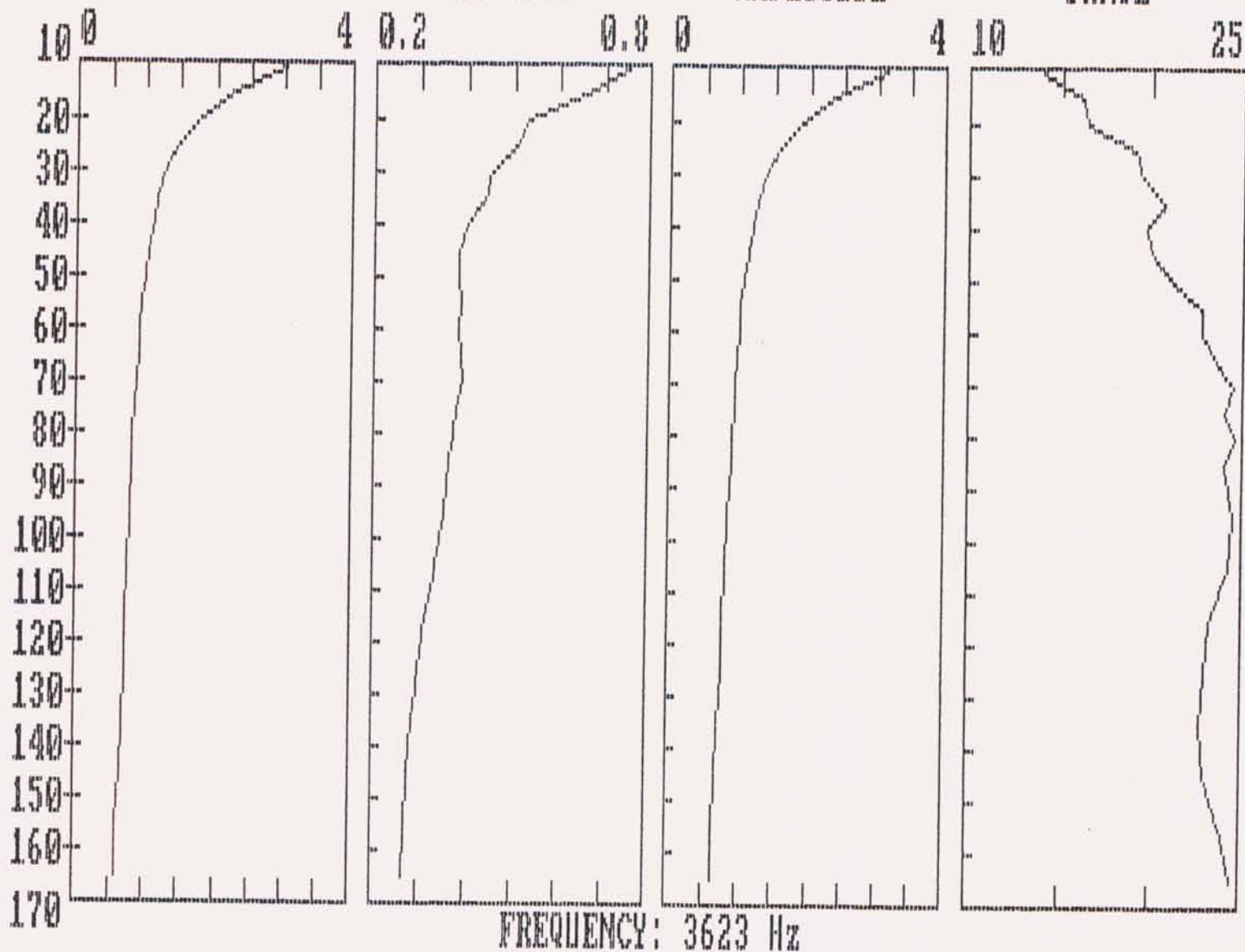
BA89-4 EM LOG

IN PHASE

OUT PHASE

AMPLITUDE

PHASE



0

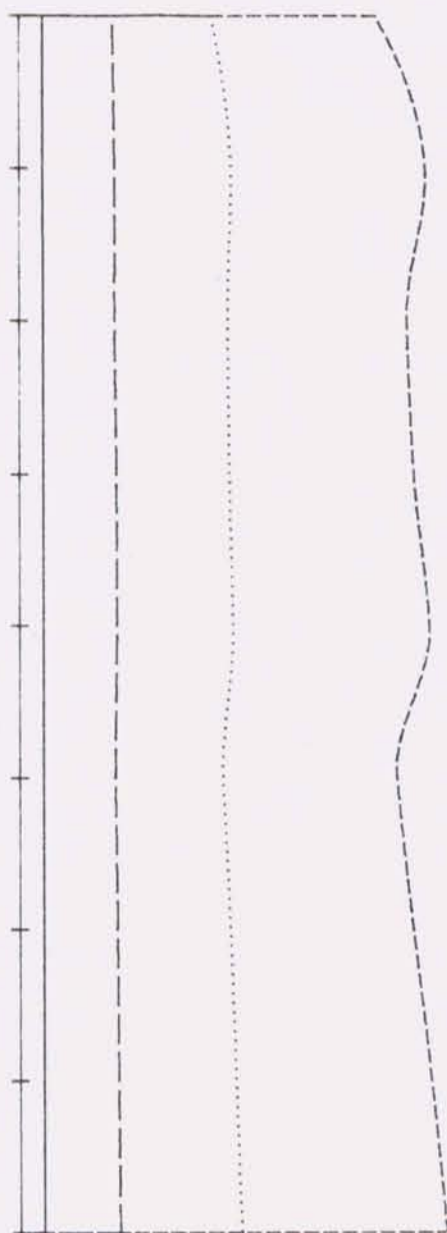
-50

-100

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-200

-250



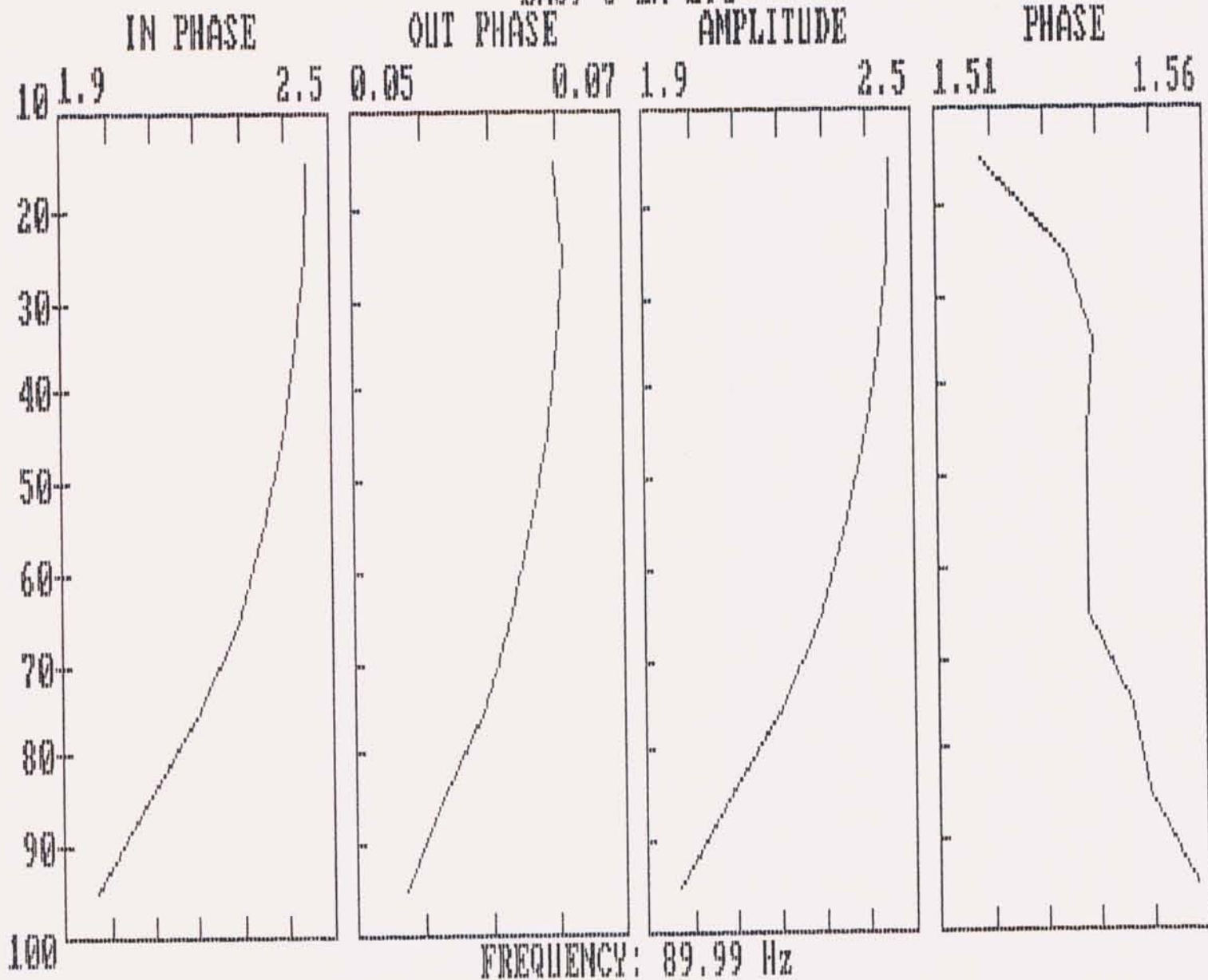
FALCONBRIDGE LTD

BAY PROJECT, ADAMS PLATEAU
BAY GRID, DDH 5
BOREHOLE ELECTROMAGNETIC SURVEY
PHASE ANGLE PROFILES, (1 cm = 5 deg)

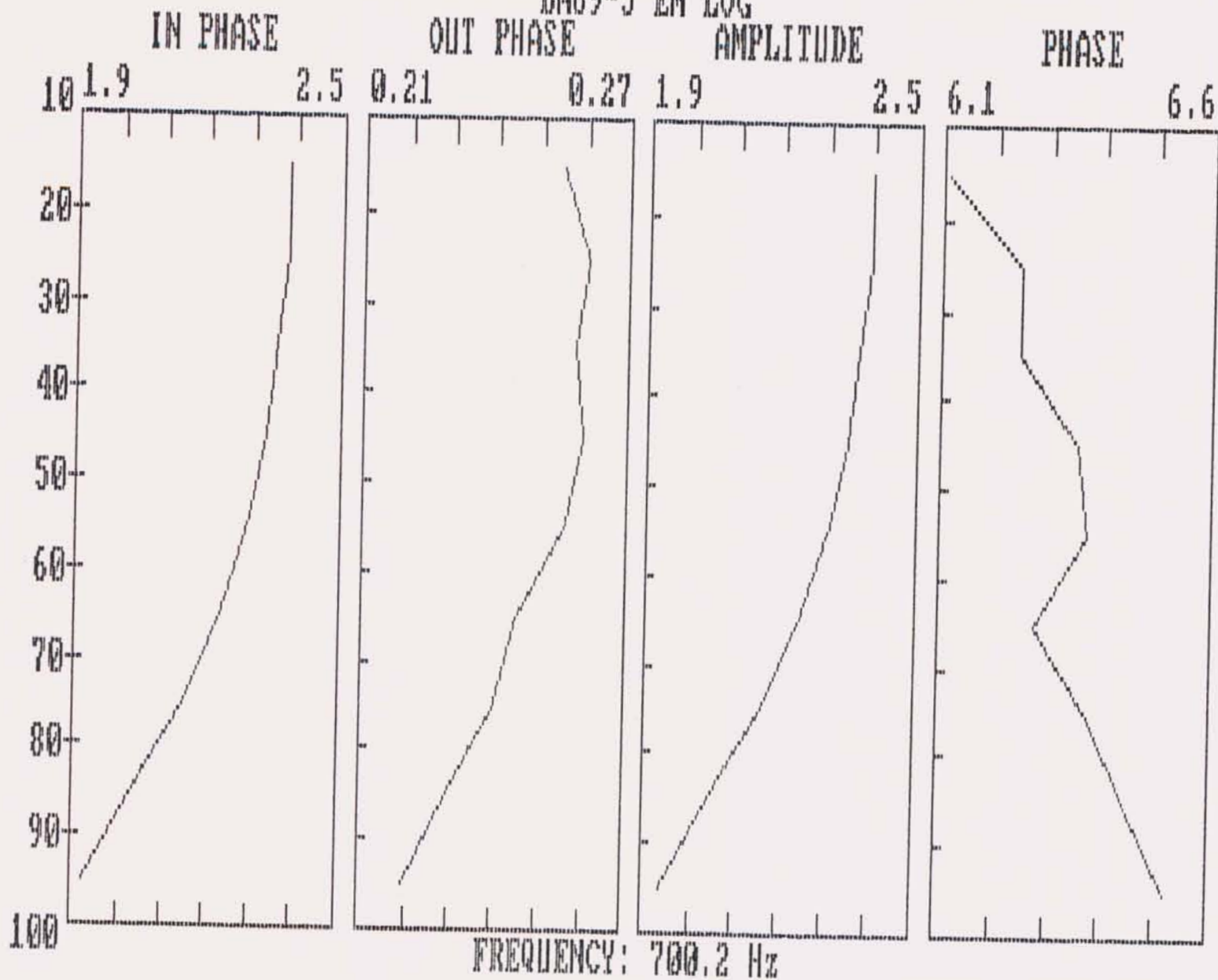
90 hz solid line, 700 hz long dashes
1800 hz dotted line, 3620 hz short dashes
SCALE 1:500

DELTA GEOSCIENCE LTD

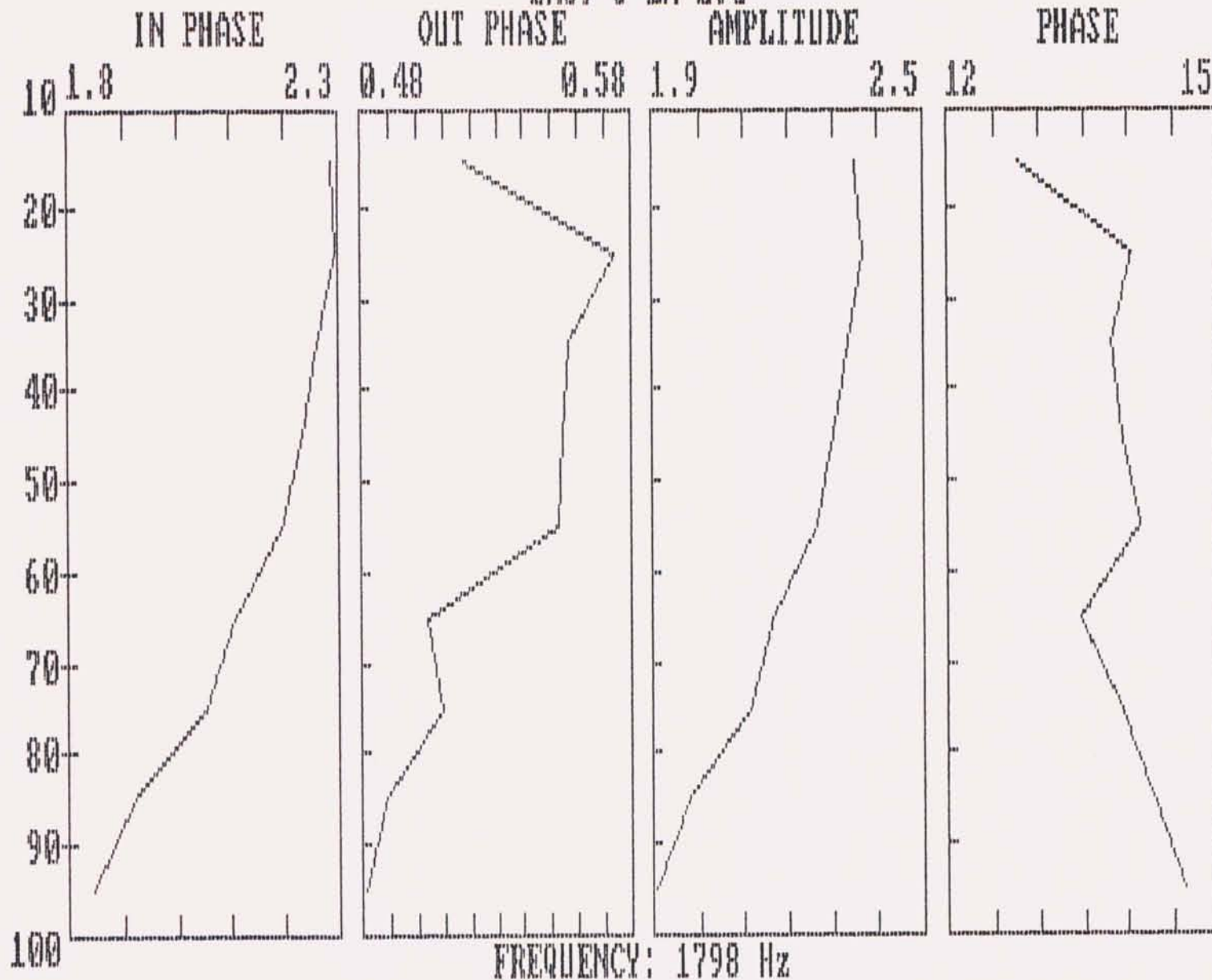
BA89-5 EM LOG



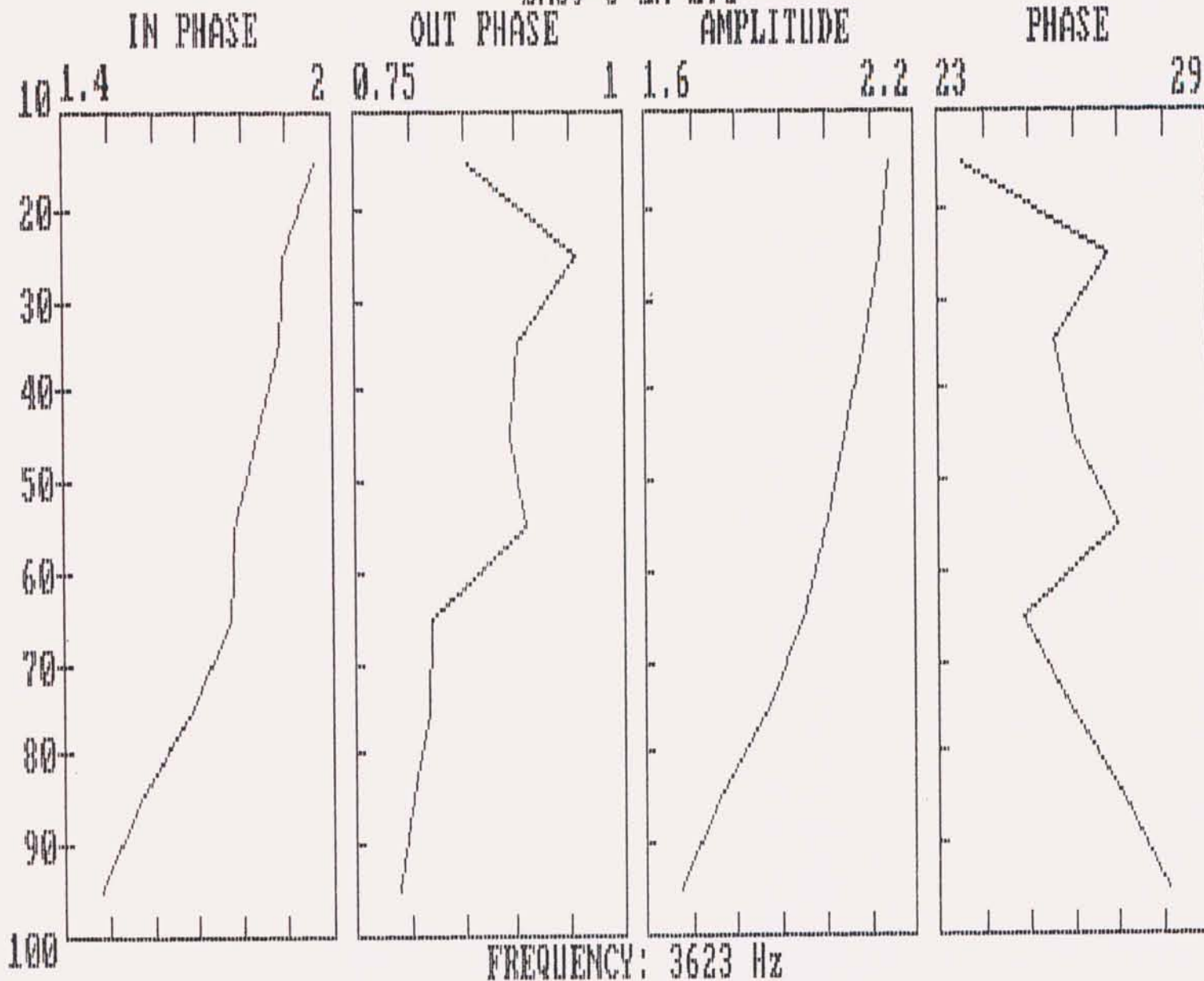
BA89-5 EM LOG



BA89-5 EM LOG



BA89-5 EM LOG



0

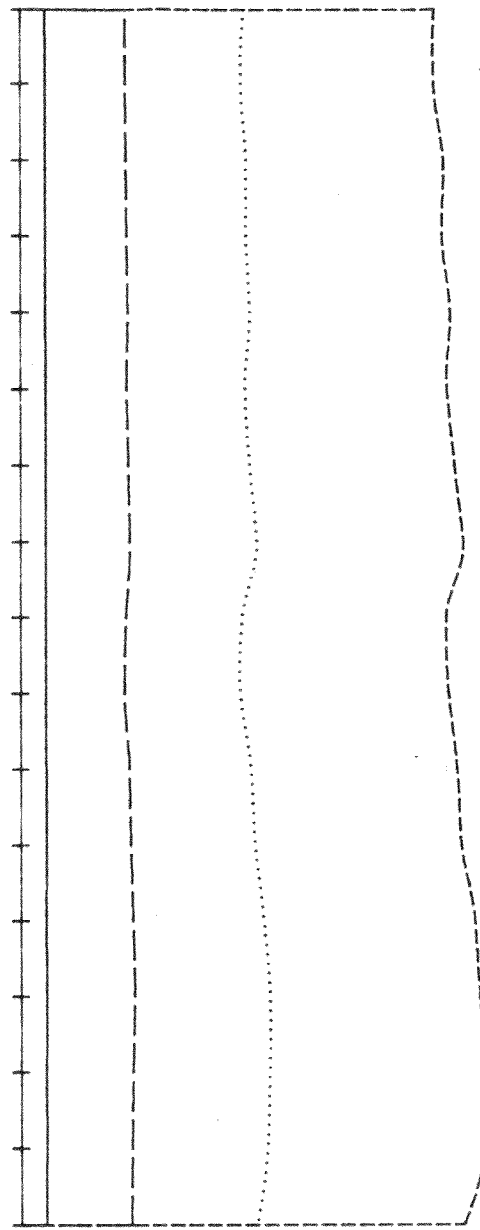
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-200

-250



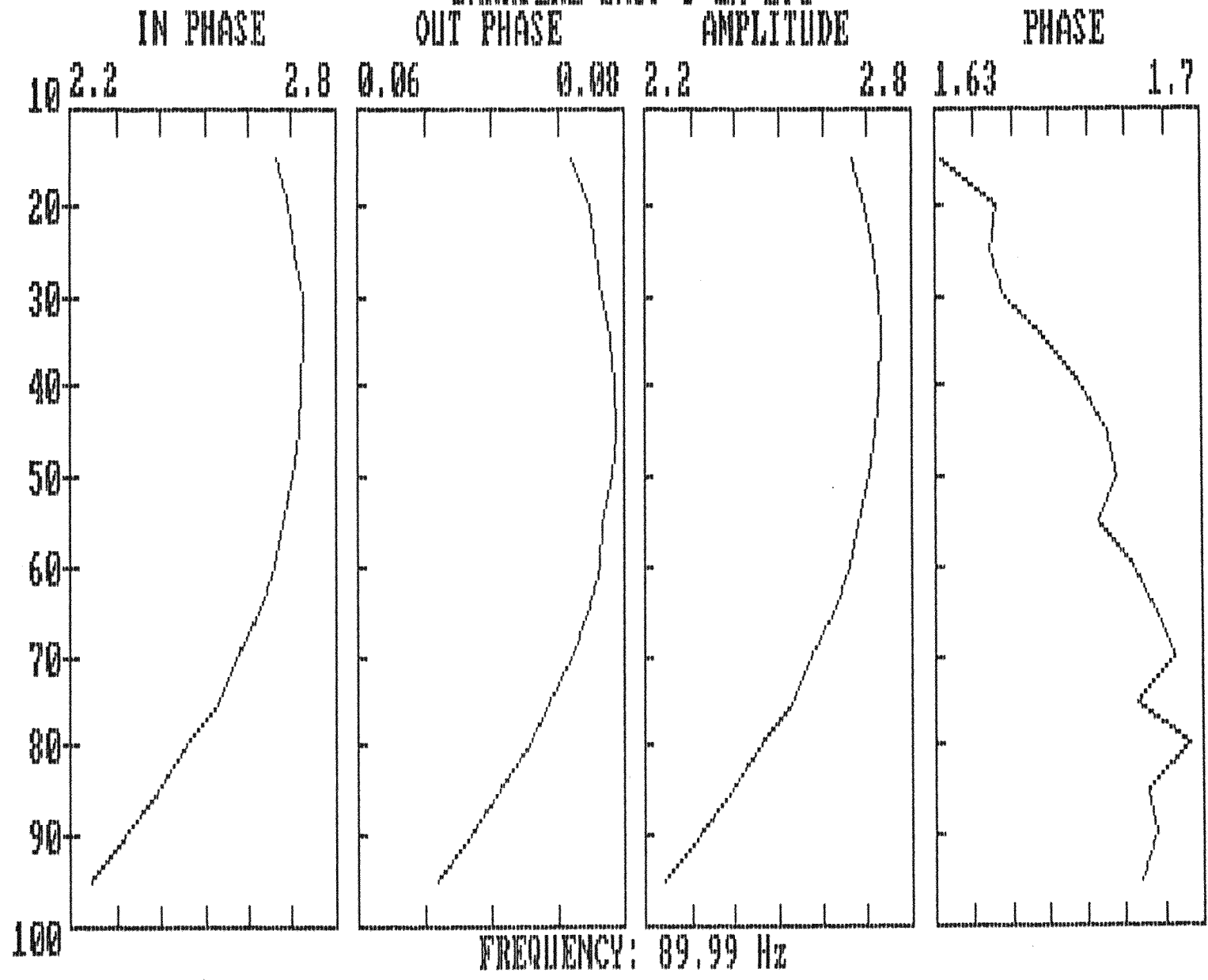
FALCONBRIDGE LTD

BAY PROJECT, ADAMS PLATEAU
BAY GRID, DDH 6
BOREHOLE ELECTROMAGNETIC SURVEY
PHASE ANGLE PROFILES, (1 cm = 5 deg)

90 hz solid line, 700 hz long dashes
1800 hz dotted line, 3620 hz short dashes
SCALE 1:500

DELTA GEOSCIENCE LTD

BARRIER BA89-6 EM LOG



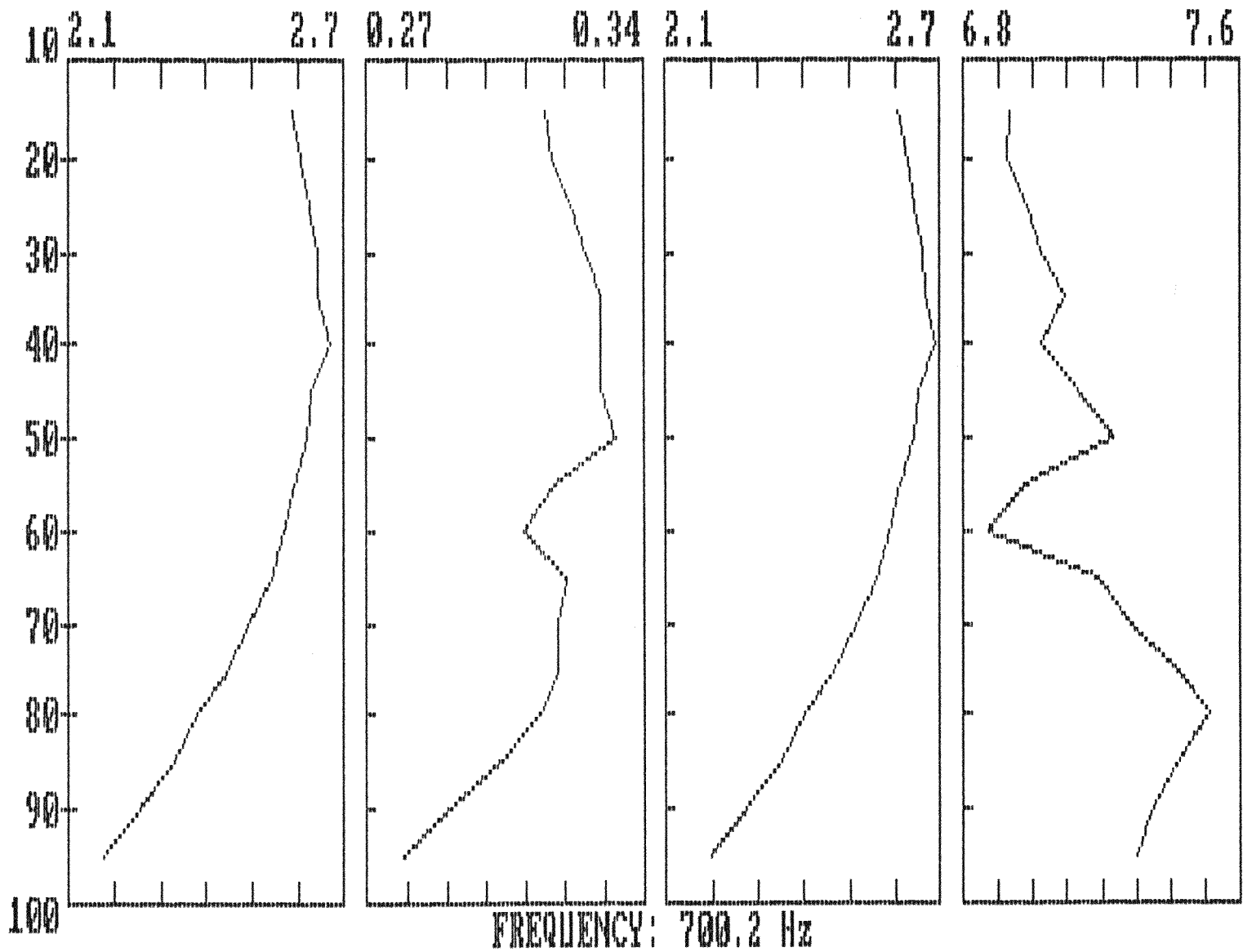
BARRIERE B089-6 EM LOG

IN PHASE

OUT PHASE

AMPLITUDE

PHASE



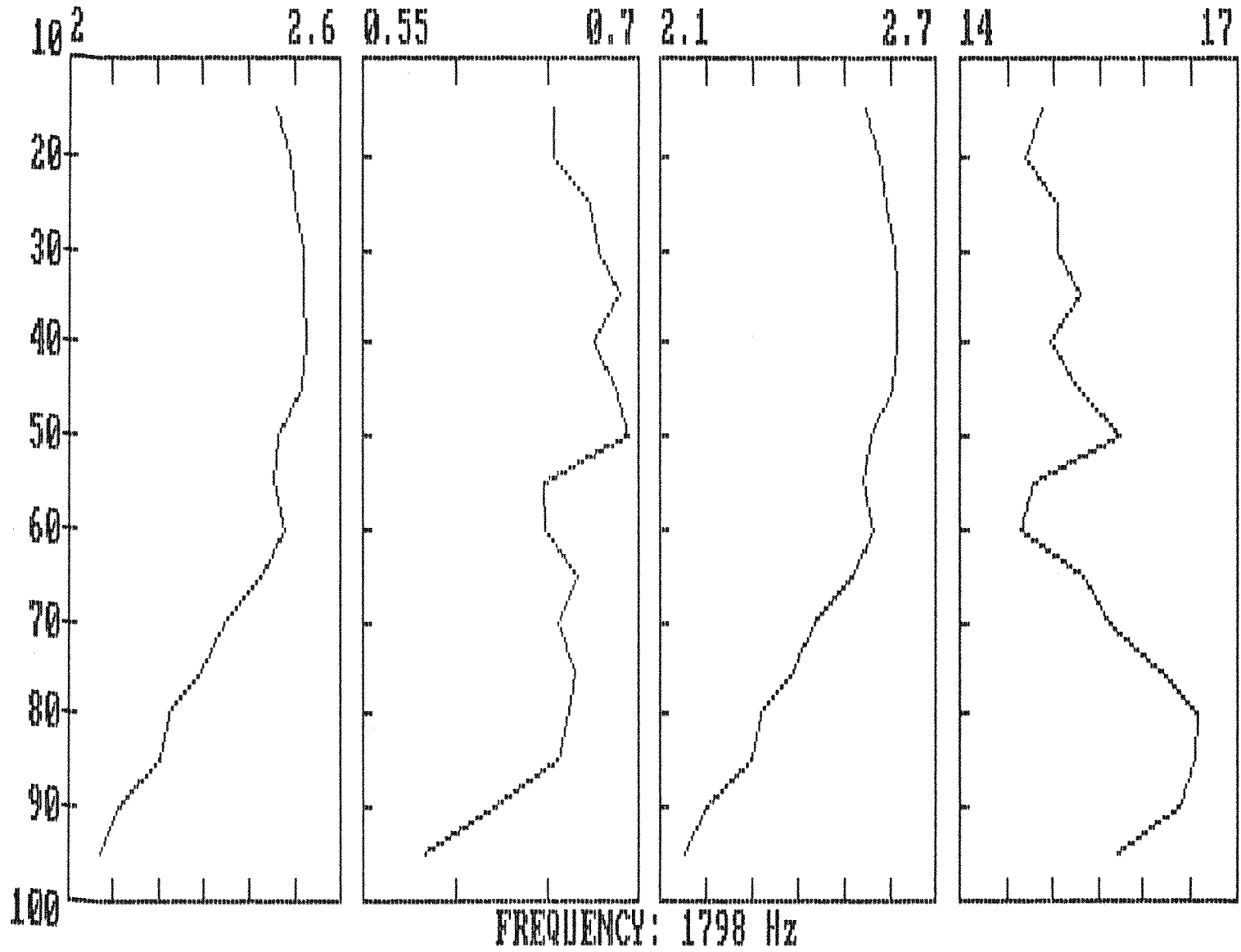
BARRIERE BA89-6 EM LOG

IN PHASE

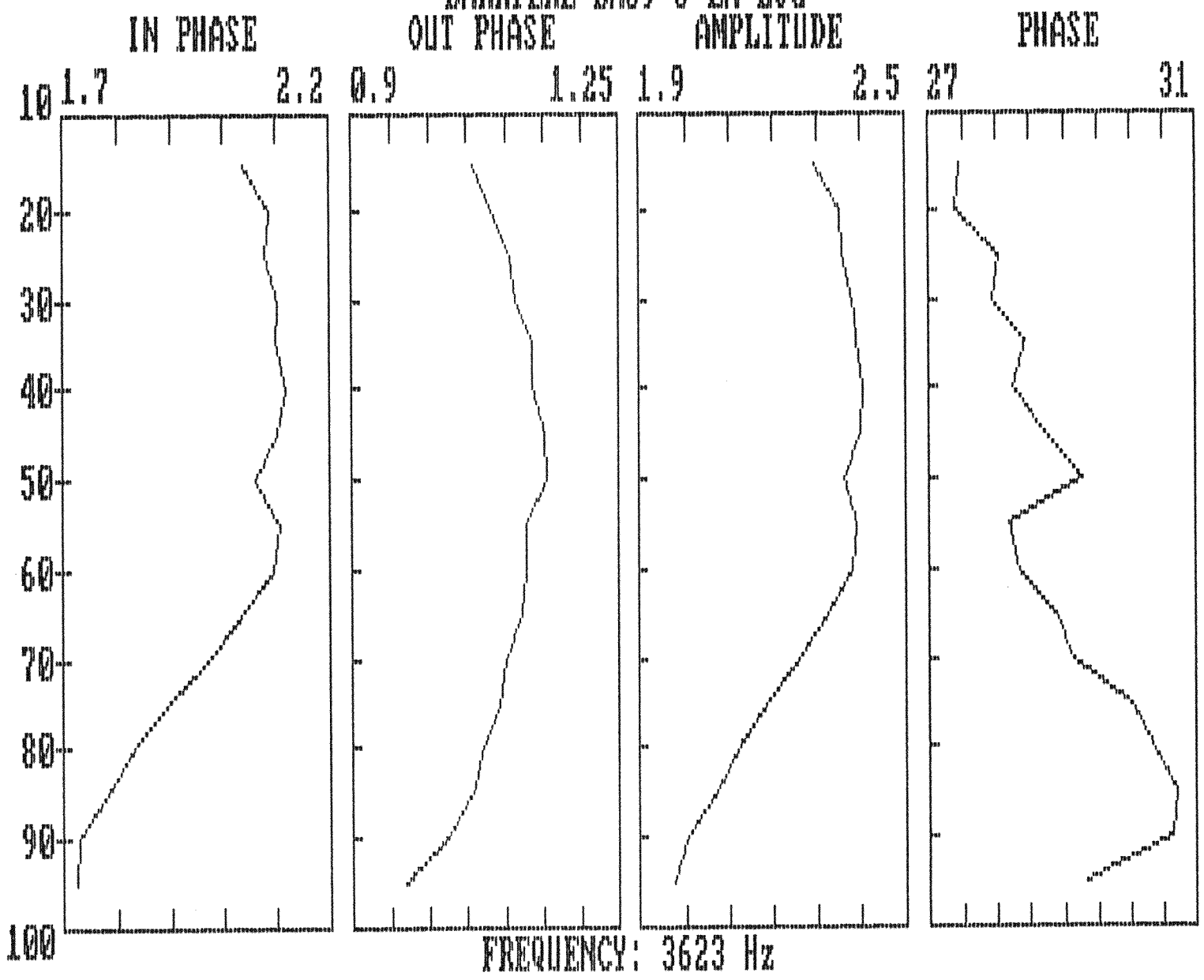
OUT PHASE

AMPLITUDE

PHASE



BARRIER BAB9-6 EM LOG



0

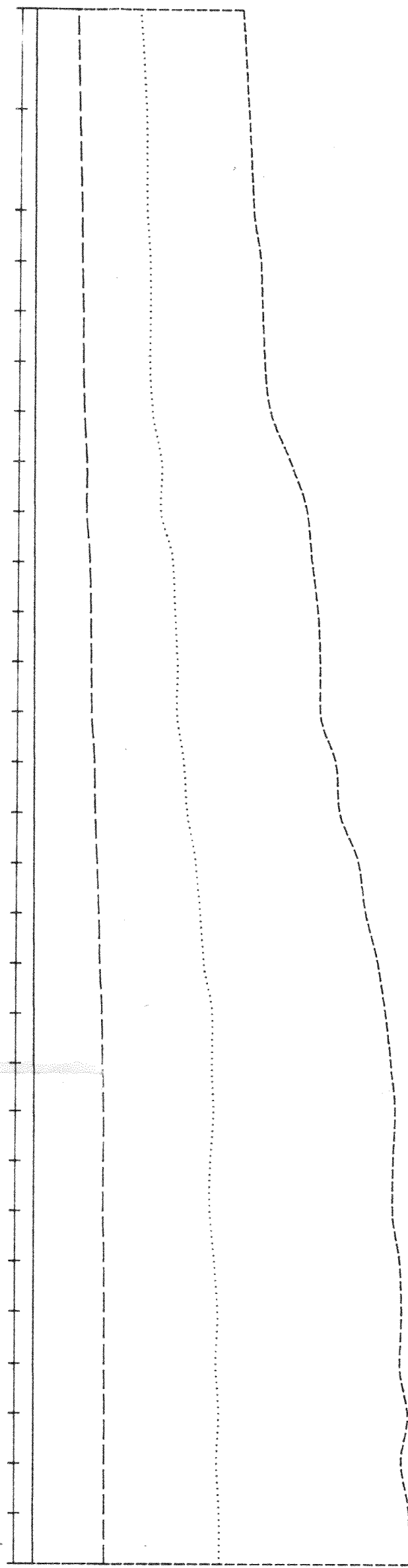
-50

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-200

-250



FALCONBRIDGE LTD

BAY PROJECT, ADAMS PLATEAU
BAY GRID, DDH 7
BOREHOLE ELECTROMAGNETIC SURVEY
PHASE ANGLE PROFILES, (1 cm = 5 deg)

90 hz solid line, 700 hz long dashes
1800 hz dotted line, 3620 hz short dashes
SCALE 1:500

DELTA GEOSCIENCE LTD

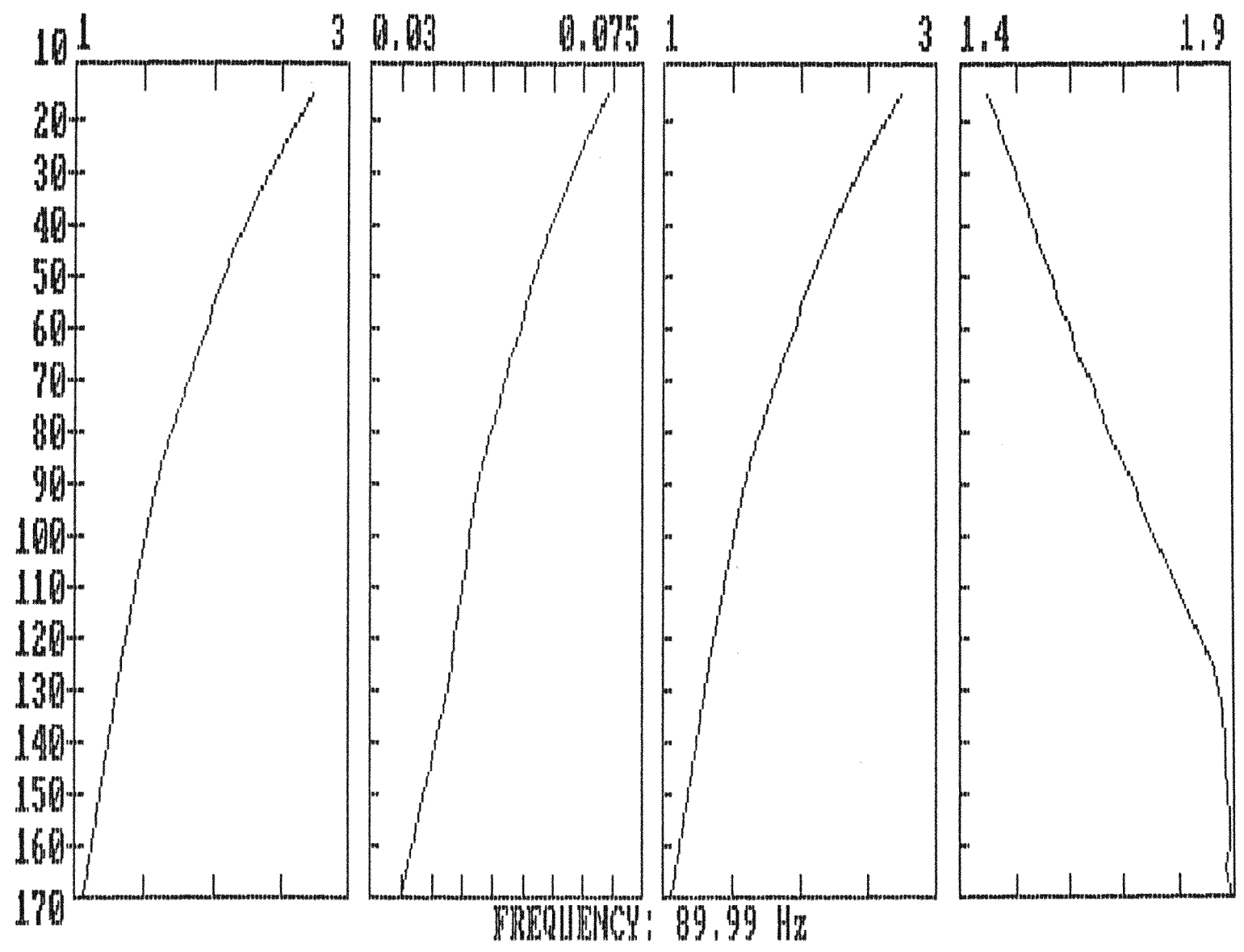
BARRIER BA89-7 EM LOG

IN PHASE

OUT PHASE

AMPLITUDE

PHASE



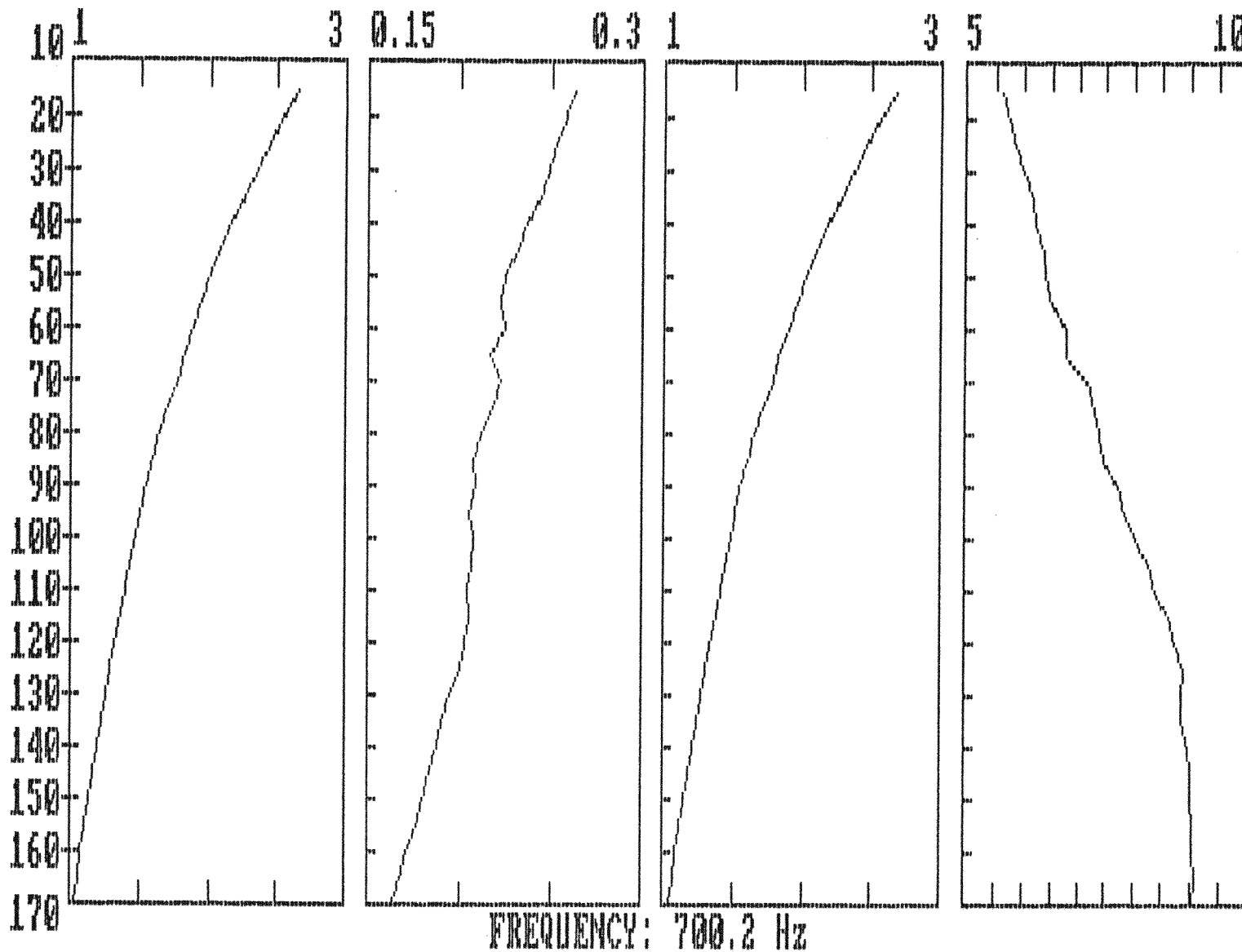
BARRIERE BA89-7 EM LOG

IN PHASE

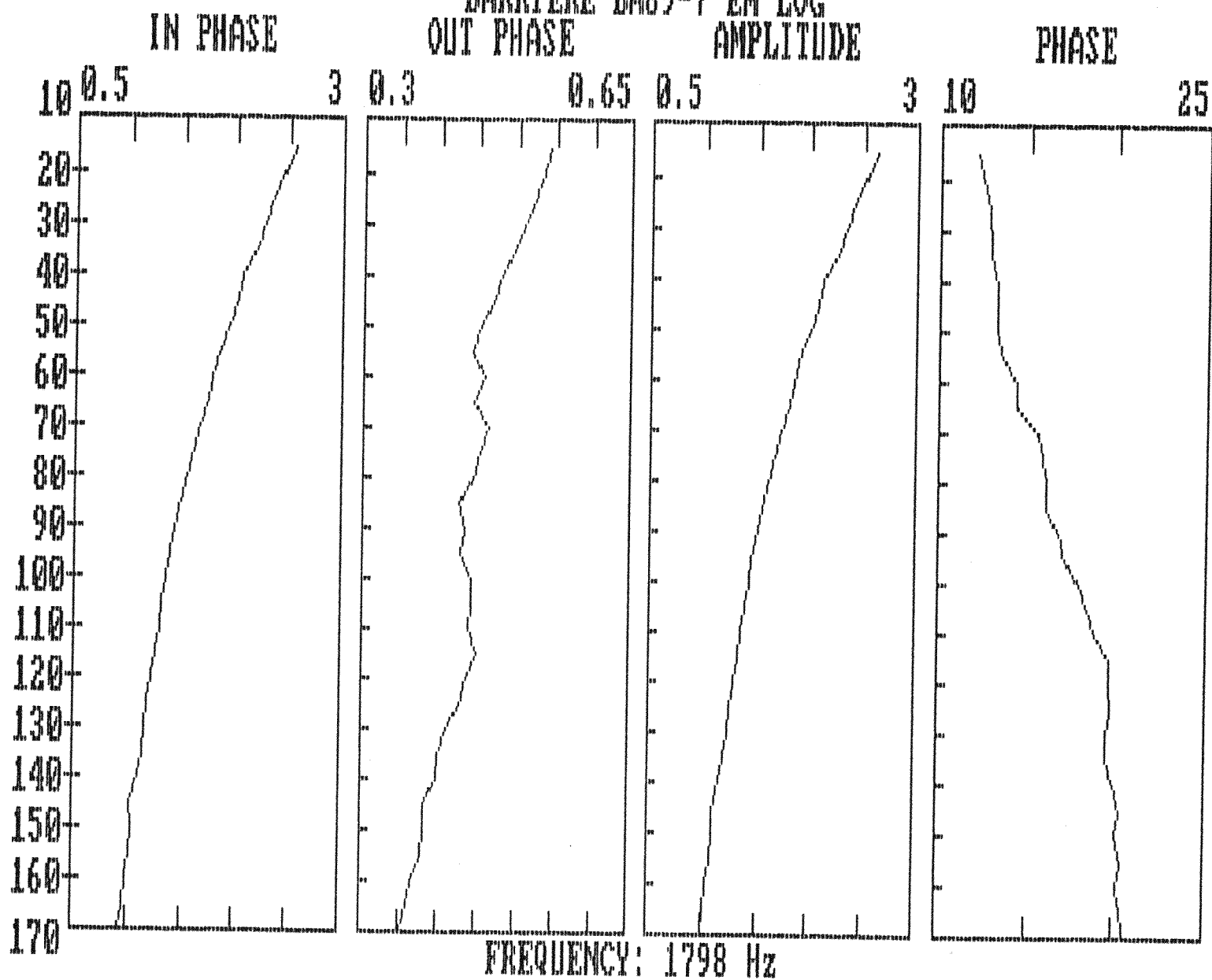
OUT PHASE

AMPLITUDE

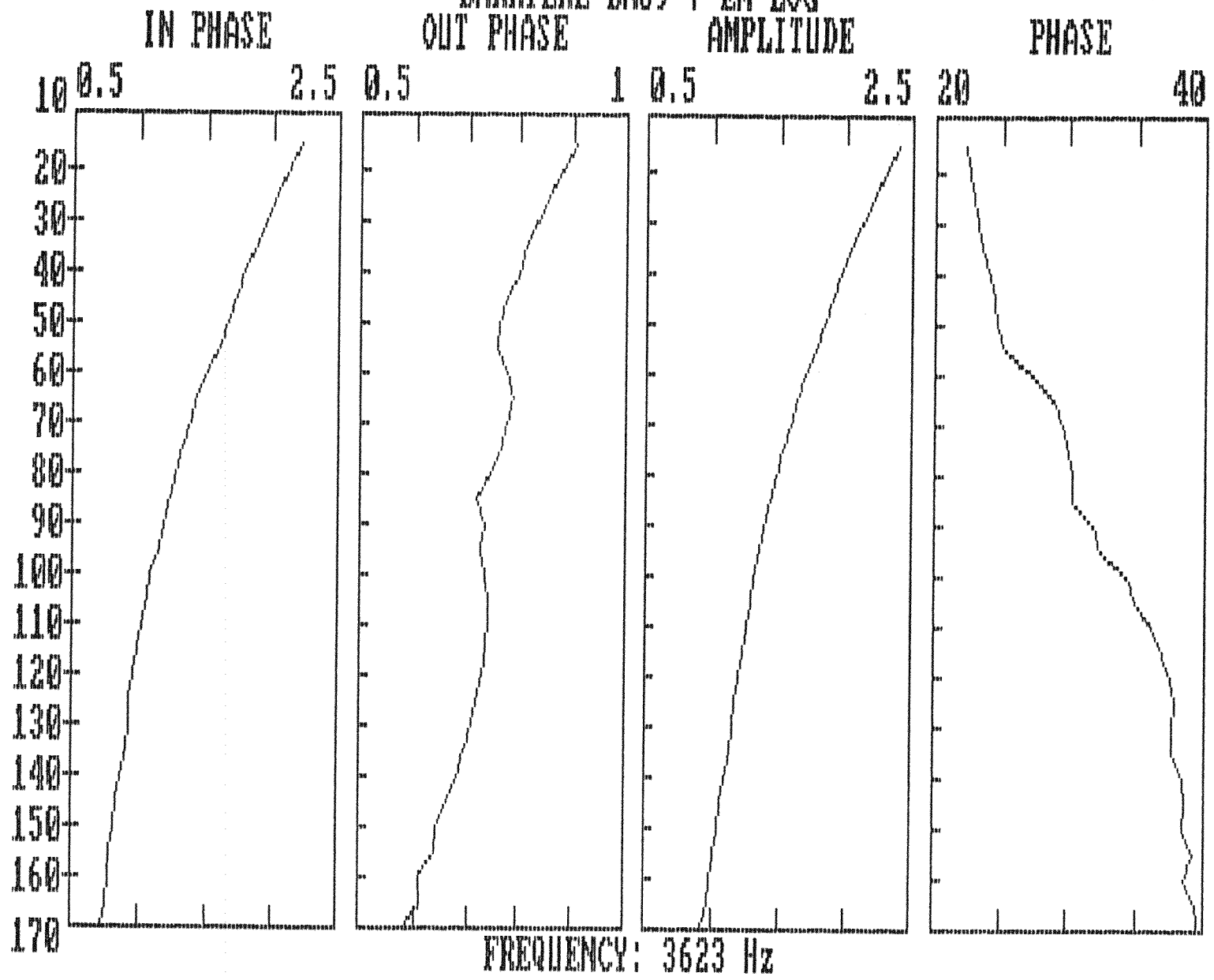
PHASE



BARRIERE BAB9-7 EM LOG
OUT PHASE AMPLITUDE



BARRIER BA89-7 EM LOG



0

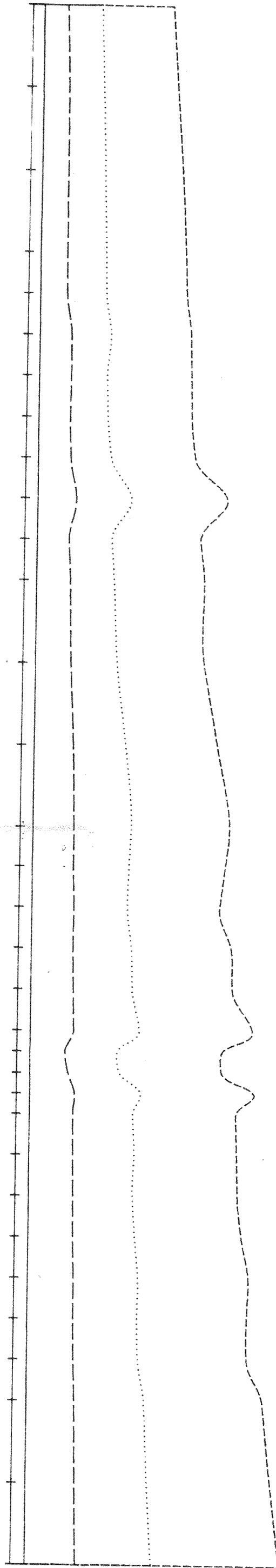
-50

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-200

-250



FALCONBRIDGE LTD

BAY PROJECT, ADAMS PLATEAU
BAY GRID, DDH 8
BOREHOLE ELECTROMAGNETIC SURVEY
PHASE ANGLE PROFILES, (1 cm = 5 deg)

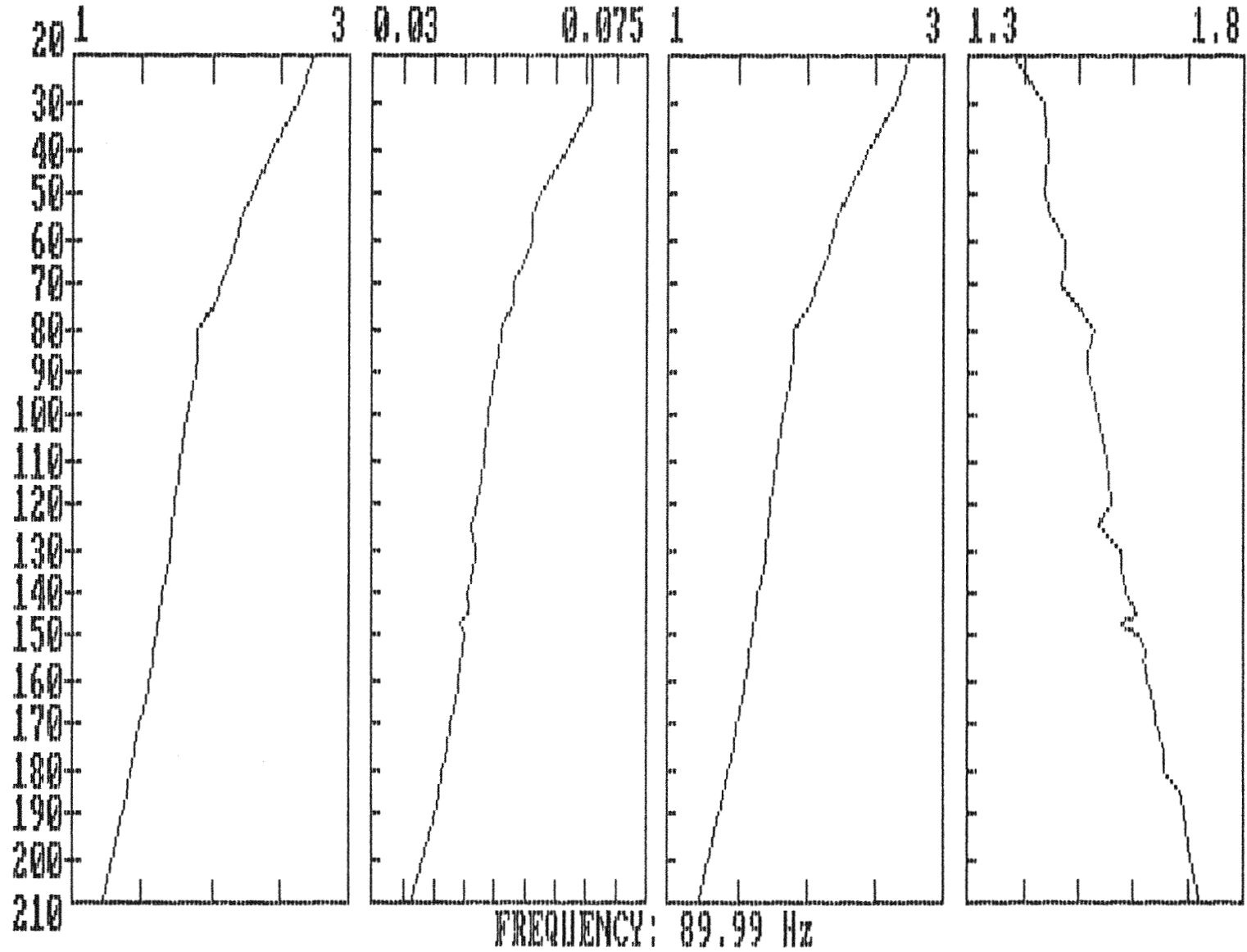
90 hz solid line, 700 hz long dashes
1800 hz dotted line, 3620 hz short dashes
SCALE 1:500

DELTA GEOSCIENCE LTD

BARRIERE DDH BA89-8 EM LOG
OUT PHASE AMPLITUDE

IN PHASE

PHASE



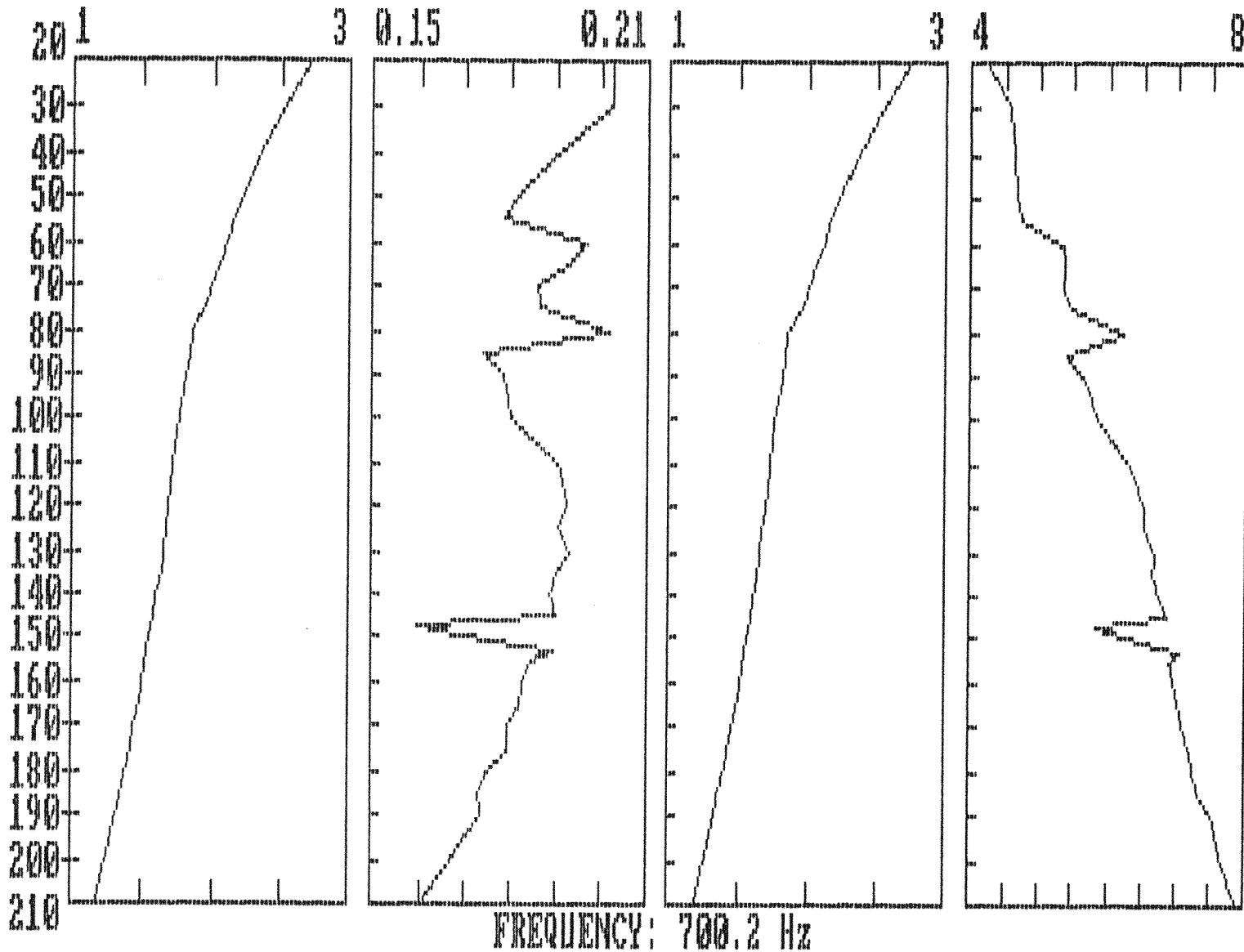
BARRIERE DDH BAB9-8 EM LOG

IN PHASE

OUT PHASE

AMPLITUDE

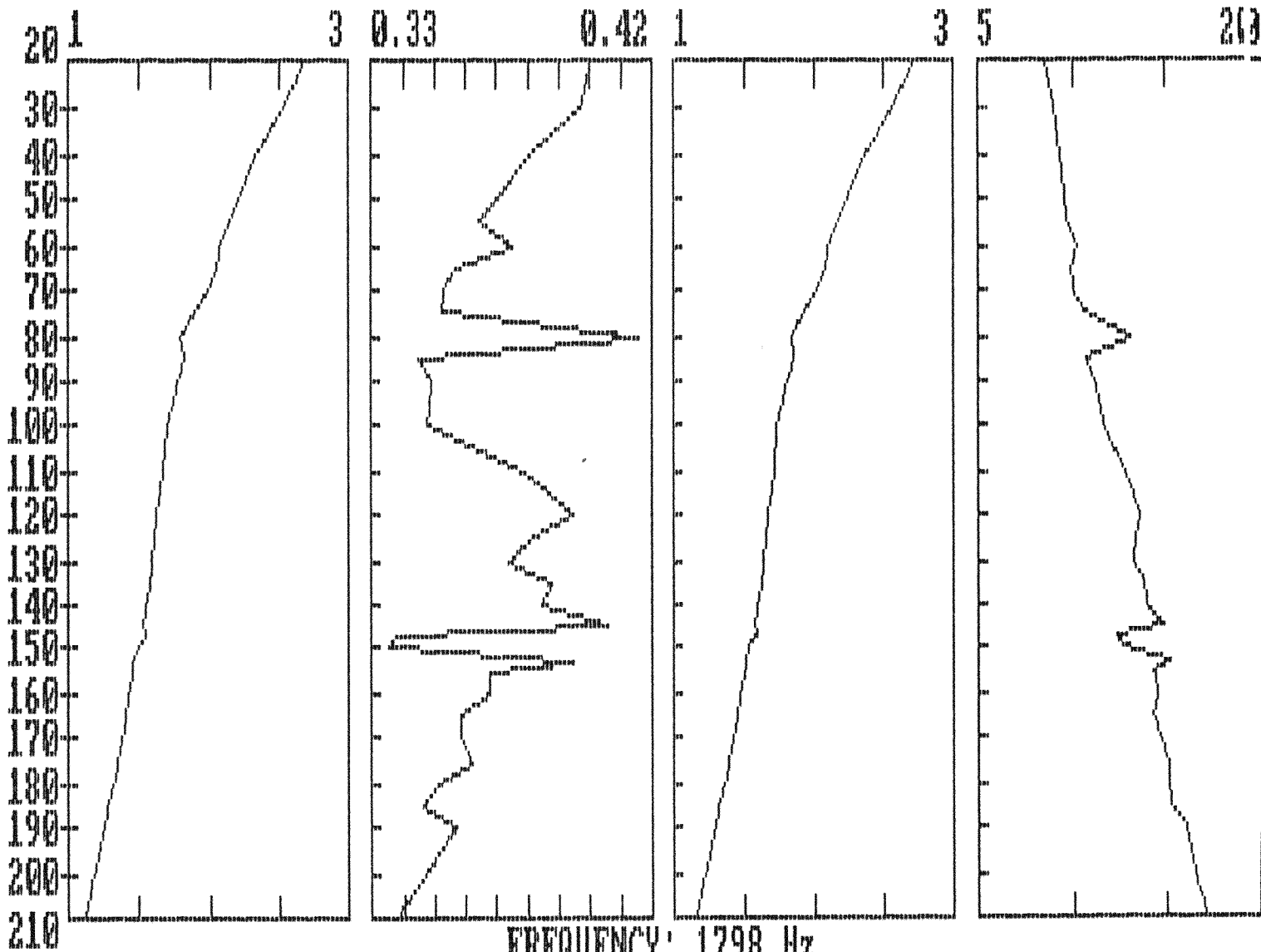
PHASE



BARRIERE DDH BAB9-8 EM LOG
OUT PHASE AMPLITUDE

IN PHASE

PHASE



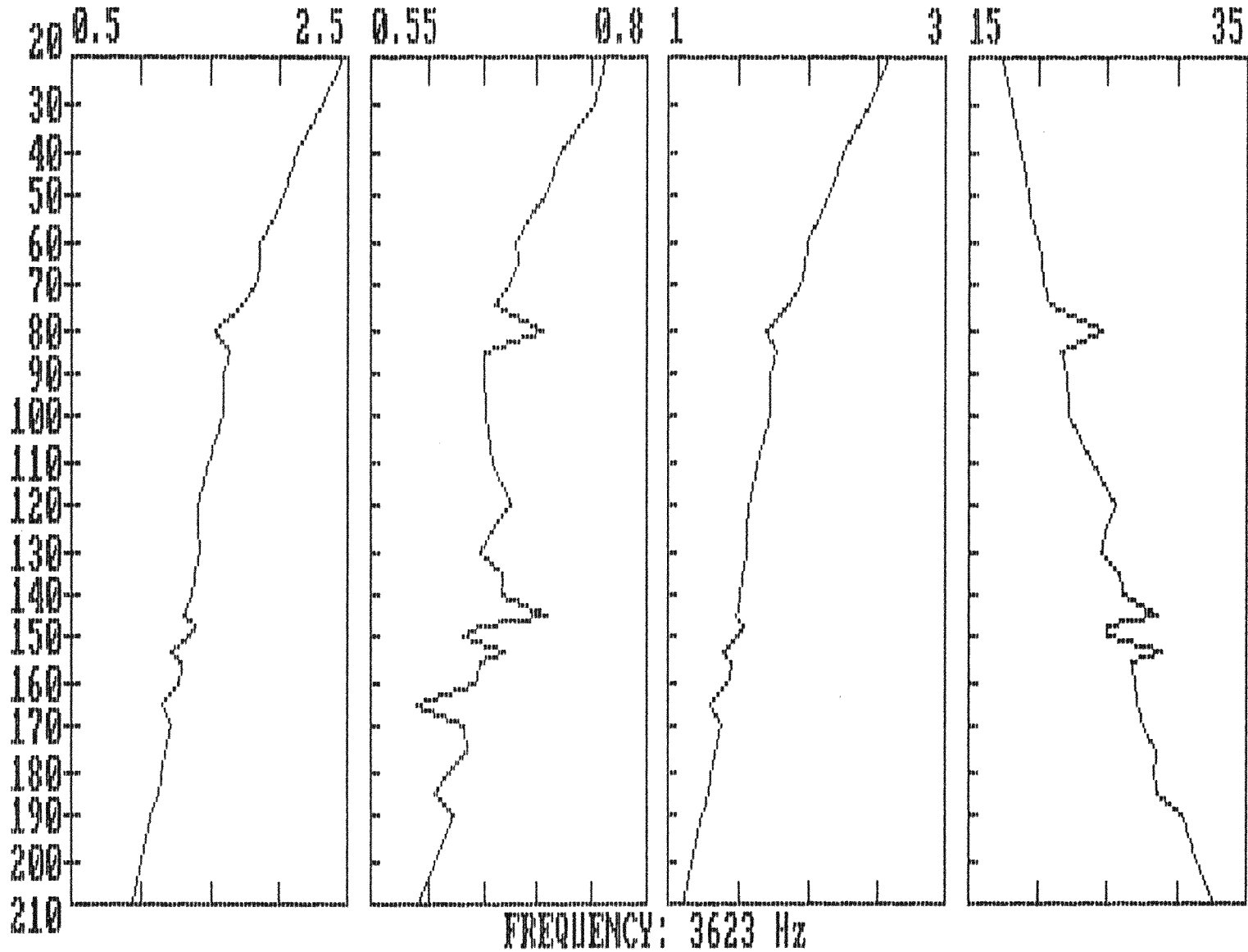
BARRIER DDH BAB9-8 EM LOG

IN PHASE

OUT PHASE

AMPLITUDE

PHASE



0

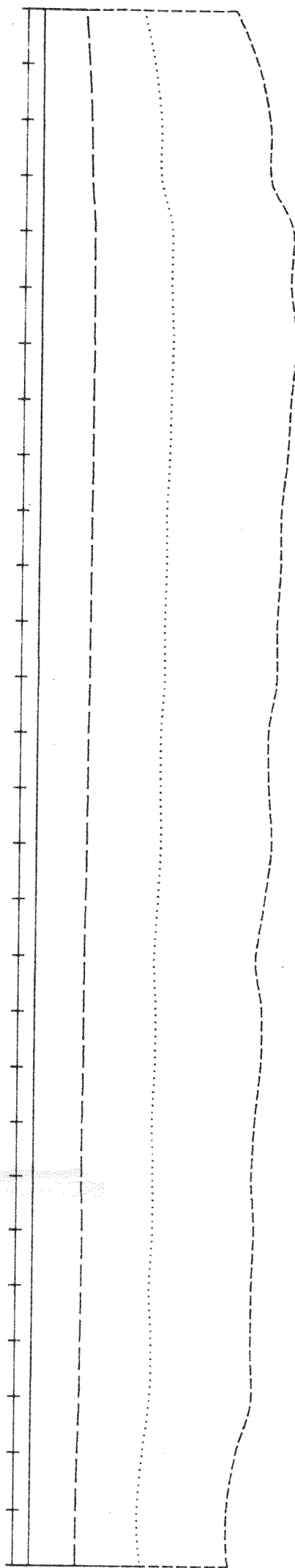
-50

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-250



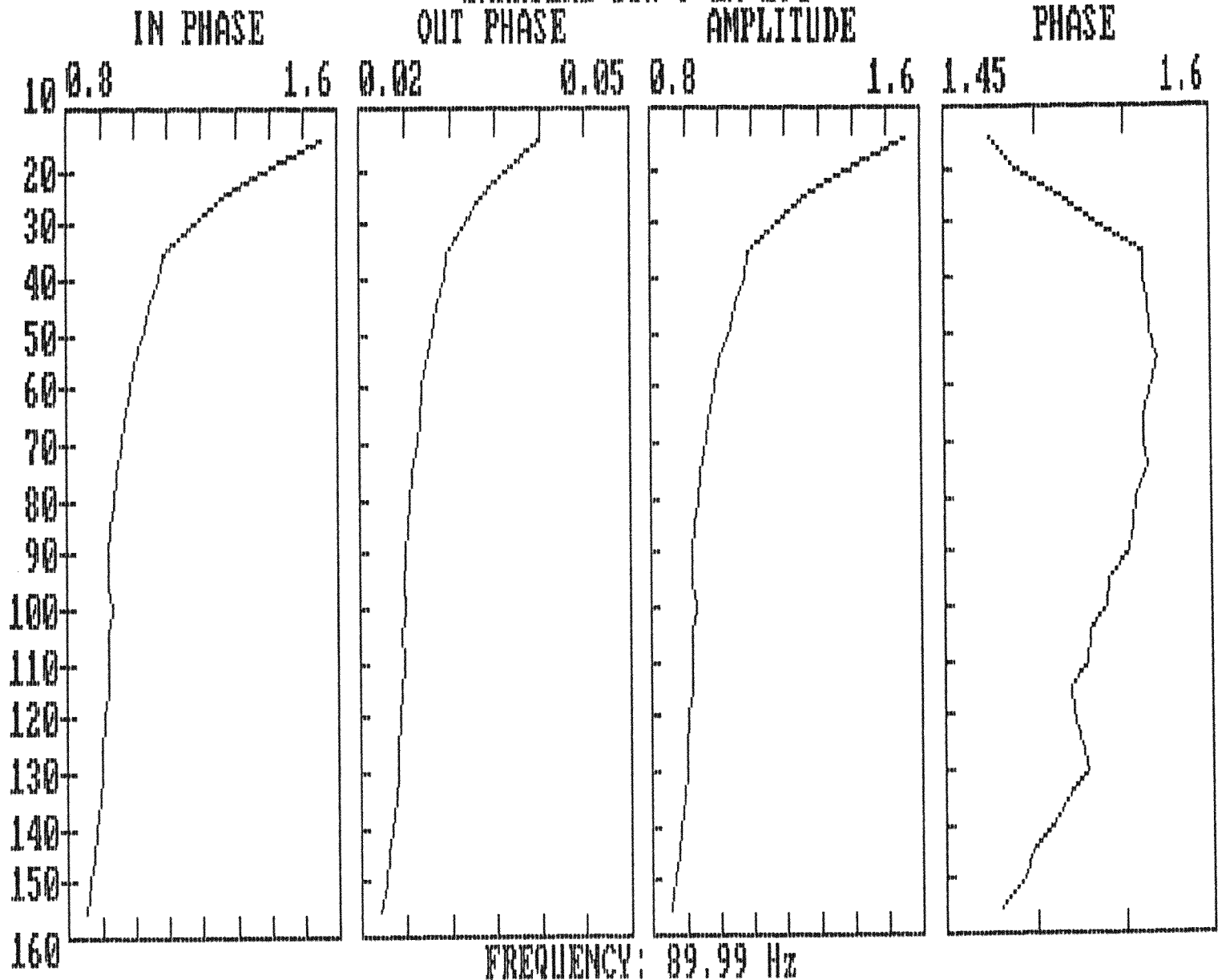
FALCONBRIDGE LTD

BAY PROJECT, ADAMS PLATEAU
BAY GRID, DDH 9
BOREHOLE ELECTROMAGNETIC SURVEY
PHASE ANGLE PROFILES, (1 cm = 5 deg)

90 hz solid line, 700 hz long dashes
1800 hz dotted line, 3620 hz short dashes
SCALE 1:500

DELTA GEOSCIENCE LTD

BARRIERE DDH 9 EM LOG
OUT PHASE AMPLITUDE



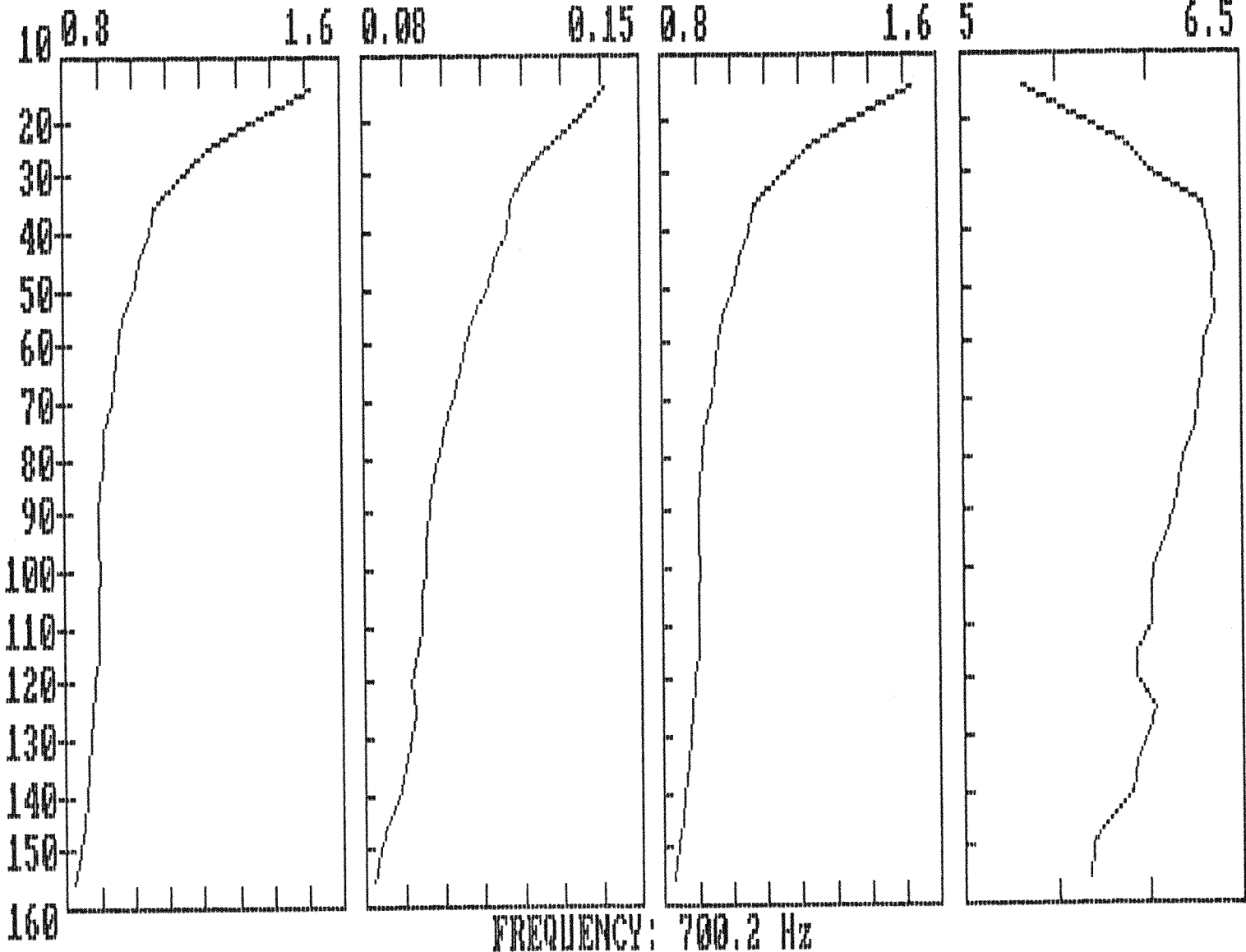
BARRIERE DDH 9 EM LOG

IN PHASE

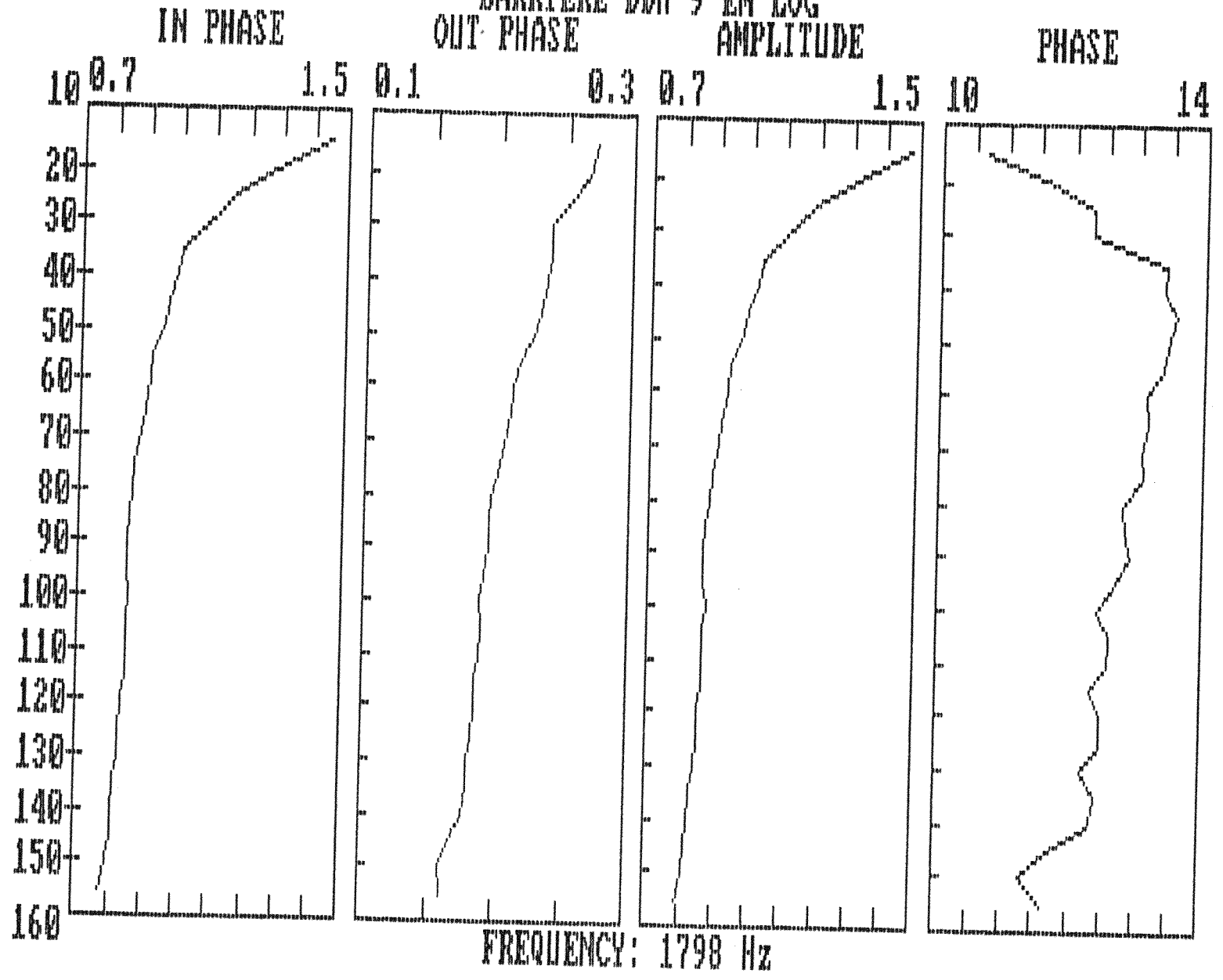
OUT PHASE

AMPLITUDE

PHASE



BARRIER DDH 9 EM LOG
OUT PHASE AMPLITUDE



BARRIERE DDH 9 EM LOG
OUT PHASE AMPLITUDE

