

(416) 621-6682

John Betz Limited

7 BOXBURY ROAD
ETOBICOKE, ONT.
CANADA, M9C 2W1

5976

REPORT ON THE MAXMIN II EM SURVEY
BP MINERALS LTD.
BAP CLAIM GROUP
OMINECA MINING DIVISION, B. C.

940/8E 5976 BAP

Toronto, Ontario
August, 1976

John Betz Limited

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT

NO. 5976 MAP

ASSESSMENT REPORT
on the
BAP Mineral Claims

Omineca Mining Division, B.C.

MAXMIN II EM SURVEY

by

John Betz Limited

for

BP Minerals Limited

August 1976

*(S) Gates MA (Oxon) MSc DSc.
BP Minerals Limited*

BAP MINERAL CLAIMS

located in the Kliyul Creek area

11 kilometres SSE Johanson Lake

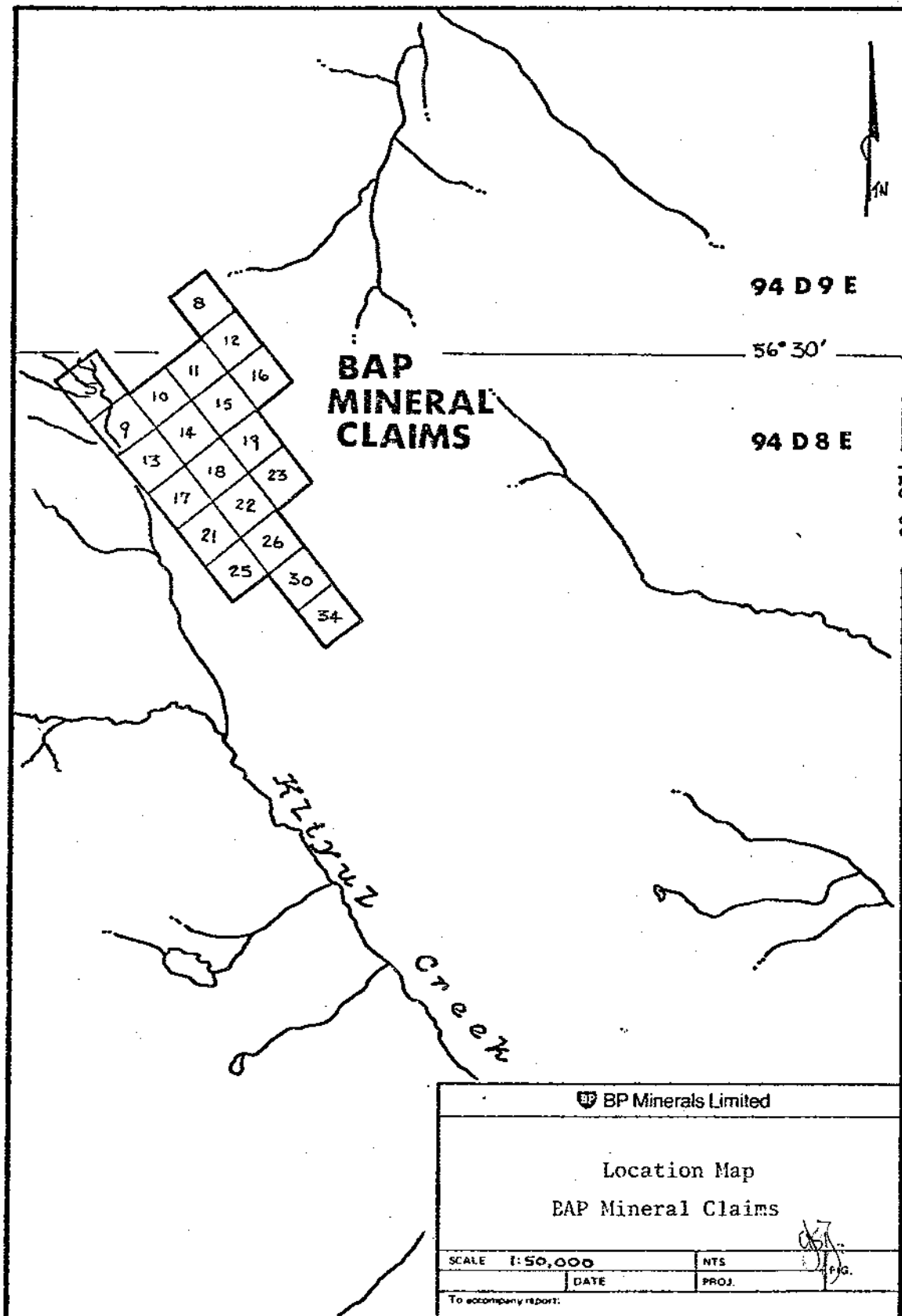
Omineca Mining Division, B.C.

Owned by

BP Minerals Limited

<u>Claim number(s)</u>	<u>Record number(s)</u>
BAP 5	127997
BAP 8	128034
BAP 9-19	127999-128009
BAP 21-22	128035,128036
BAP 23	128011
BAP 25	128013
BAP 26	128014
BAP 30	128018
BAP 34	128022

Total 20 mineral claims



STATEMENT OF COSTS

BAP Mineral Claims

Line cutting	- G. Auger (July 14, 1976) (invoice attached)	
	- exploration service contractor	
	- 2.87 line miles @ \$175/line mile (4.6 km)	
	- \$503.78	<u>\$503</u>
Secant chaining and EM survey		
(July 22-25)	- John Betz Limited (invoice attached)	
	- geophysical contractor	
	- 6.5 line kilometres	
	- \$3,330	<u>\$3,330</u>
Mobilization and demobilization of J. Betz		
(July 21 and July 30)	- Van-P.G.-Van \$118 (CP)	
	- P.G.-Johanson Lake-P.G. \$384 (charter)	
	- total \$502	<u>\$502</u>
Board and accommodation		
	- 8 man days @ \$15/man day	<u>\$120</u>
Helicopter support		
(July 14, 21, 22, 23, 24, 25, 27, 28, 29)	- Vancouver Island Helicopters Ltd.	
	- Bell 47G 3-B2	
	- \$160/hour contract	
	- \$20/hour fuel	
	- total 13.8 hours	
	- 50% applied 6.9 hours @ \$180/hr	<u>\$1,242</u>
TOTAL		<u>\$5,667</u>

BAP MINERAL CLAIMS

Claim Credit Apportionment

\$5,500 applied -

One year's work at \$100 certificate of work
for BAP 5,9,12,13,16,17,25,30,34 (August month of record)
for BAP 8,21 (September month of record)
11 certificates of work @ \$100 = \$1100

One year's work at \$200 certificate of work
for BAP 5,9,10,11,12,13,14,15,16,17,18,
19,23,25,26 (August month of record)
for BAP 8,21,22 (September month of record)
18 certificates of work @ \$200 = \$3600

Two years' work at \$200 certificate of work
for BAP 30,34 (August month of record)
4 certificates of work @ \$200 = \$800

Total \$5,500

The following invoice from John Betz Limited is for the total costs incurred for two MAXMIN II surveys in the Johanson Lake area, B.C.

The amount applied towards the BAP mineral claims (\$3300) is a proportionate amount of the total.

One day (July 30) was spent conducting an EM survey over another property.

(416) 621-6692

John Betz Limited

7 BOXBURY ROAD
ETOBICOKE, ONT.
CANADA, M9C 2W1

INVOICE

August 19, 1976

BP Minerals Ltd.,
1199 West Pender St.,
Vancouver, B. C.
V6E 2R1

Attention: C. D. S. Bates

FOR PROFESSIONAL SERVICES

July 21 - July 30	Chaining & MaxMin II EM work Johanson Lake area, B.C 10 days @ \$200/day	\$2000.00
July 31 - Aug. 10	Data reduction, plotting, interpretation, & report writing 3 days @ \$200/day	600.00
Aug. 1	Travelling Vancouver to Toronto 1 day at \$100/day	<u>100.00</u>
	Subtotal	\$2700.00

FOR JOB-RELATED EXPENSES

July 19-20	Room, Vancouver	59.95
July 21	Air cargo of EM gear, Van.-Prince George	156.40
July 30	Air cargo of EM gear, Prince George-Van.	56.66
July 31	Air cargo clothing, Prince George-Van.	10.00
July 31	Taxi Vancouver	8.00
Aug. 1	Taxi Vancouver	9.00
July 30-31	Room and meals	98.52
Aug. 1	Air fare Vancouver to Toronto	178.00
Aug. 1	Air cargo Vancouver to Toronto	128.40
Aug. 1	Taxi Toronto	7.00
July 21-30	MaxMin II charges	200.00
Aug. 9	Draughting fees	<u>75.00</u>
	Total	\$3686.53

APPROVED FOR PAYMENT

CHARGE 80022

DATE.....INTLS *[Signature]*

STATEMENT

in account with

GERARD AUGER

Line Cutting & Staking — Geo. Chem, Mag. & E.M.

P.O. Box 1055, Phone 847-2834

SMITHERS, B.C. July 22nd 1976

M. B.P. Minerals Limited

Vancouver, B.C.

BAP line cutting group.

SEE-MOORE PRINTING LTD.

Base line	100 E.	2800	ft.
line	800 N	1000	ft
	804 N	1200	ft
	808 N	1800	ft
	812 N	1200	ft
	816 N	1800	ft
	820 N	1800	ft
	824 N	1800	ft
	828 N	1800	ft

15,200 ft

✓ 2.87 miles @ \$175.00 per mile \$503.78

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John Betz Limited

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PROFILES

Legend Sheet
Max-Coupled Mode -
 Model Line
 Lines 804N, 808N, 812N, 816N, 820N, 824N, 828N
Min-Coupled Mode - Line 820N

POCKET

Plan map showing topo contours and interpreted conductive zones #1
 CLAIM MAP #2

REPORT ON THE MAXMIN II EM SURVEY FOR BP MINERALS LIMITED, BAP CLAIM GROUP, CLİYAL CREEK AREA, OMINECA MINING DIVISION, BRITISH COLUMBIA

PREAMBLE

After the assessment information and the statement of the objective of the survey are sections dealing with the equipment and its application toward the detection of massive sulphide zones. By introducing these sections before the section on the interpretation of the field results, it is the writer's intention to give the reader a definite feeling for the effectiveness of the coverage on the Bap claim group.

ASSESSMENT INFORMATION

The Bap claim group is the property of BP Minerals Ltd. It is located 7 miles SSE of Johanson Lake in the Omineca Mining Division of British Columbia.

The field work was done in July of 1976.

OBJECTIVE OF SURVEY

The objective of this survey was to test the rust-stained volcanic tuff units on the property for the existence of deep massive sulphide zones.

The existence of shallow massive sulphide zones had already been eliminated by a Crone JEM shoot-back survey in 1974.

EQUIPMENT AND PROCEDURES

The MaxMin II system was designed to operate in two modes -- one called Max-Coupled and the other Min-Coupled. The Max-Coupled mode uses in-line coplanar coils, wherein the two coils are held parallel to the mean slope of the terrain. In flat terrain, the Max-Coupled mode

is one in the same with the well-known Horizontal Loop mode. The Min-Coupled mode uses in-line mutually perpendicular coils, wherein the turns of the transmitting and receiving coils are parallel and perpendicular, respectively, to the mean slope of the terrain.

The Max-Coupled mode is the most commonly used, because it is easy to perform and it couples well with most conductor configurations, giving recognizable anomaly shapes. However, the Min-Coupled mode is of proven superiority in the case of deep, very wide conductive zones, where it gives larger anomaly amplitudes than the Max-Coupled mode. Also, the Min-Coupled anomaly shape points unequivocally to a wide source, whereas the Max-Coupled anomaly shape over a single wide conductor at depth is similar to that over two separate parallel conductors at depth.

The Max-Coupled mode was used over the entire Bap grid. The Min-Coupled mode was used on one line only in an effort to enhance the interpretation given by the Max-Coupled results.

SECANT CHAINING

The lines "run" during this survey were first secant chained to insure full control over the coil geometry (separation and tilt). This is necessary to obtain clean "in-phase" data. Clean in-phase data are necessary for the detection of deep massive sulphide bodies. This point can be better appreciated when the reader bears in mind that massive sulphide bodies nearly always have a larger in-phase than out-of-phase response over the frequency range of the MaxMin II system. None-

theless, the amplitude of the in-phase response can be small due to an appreciable body depth. The in-phase noise resulting from poor control of the coil geometry can "bury" the low amplitude in-phase response from a deep target.

A by-product of the secant chaining is a set of topographic contours with exact line and station locations over the extent of the grid. The grid can then be accurately located on a contour map made from ortho photos, by matching the two sets of contours.

In this vein, it is of interest to note that superimposition of the (reduced-scale) topo plan from secant chaining onto the topo plan from ortho photos revealed that the Bap grid is 500 ft (150 m) more grid north and 150 ft (45 m) more grid east, than originally plotted by the line cutters.

COIL SPACING AND DEPTH OF DETECTION

A horizontal-plane coil spacing of 600 ft was used during the survey to insure deep search. A 600 ft horizontally projected coil spacing is about 700 ft on the steep slopes of the Bap grid. With the small in-phase noise envelope of $\pm 1\frac{1}{2}\%$, provided by secant chaining, very large massive sulphide bodies, dipping perpendicular to the slope, can be detected to a normal-to-slope depth of 0.7 of the coil spacing, i.e. to a depth of 0.7×700 ft, or nearly 500 ft (150 m) normal to the slope. However, more realistically-sized massive sulphide bodies, e.g. strike-length \times dip-extent = 1200 ft \times 1200 ft (365 m \times 365 m), can only be detected to a normal-to-slope depth of 0.6 of the coil spacing, i.e. about $0.6 \times 700 = 420$ ft or 130 m, in the presence of a $\pm 1\frac{1}{2}\%$ in-phase

noise envelope. Of course, the depth of detection is less for smaller-sized targets. For instance, a massive sulphide zone (600 ft x 1200 ft or 180 m x 365 m) would be detectable to a normal-to-slope depth of about 350 ft or 105 m for the same coil spacing and in-phase noise envelope as stated above.

These statements, pertaining to the depth of detection, are based on scaled-modelling results*, enhanced by field results obtained by the writer over deep conductive sources**.

An example of the MaxMin II profiles, to be expected over a deep sulphide source, can be seen in the initial profile sheet, entitled "Model Line", toward the end of the report. It is clear from these profiles that a moderately large massive sulphide lense (365 m x 365 m) would be readily detectable at a normal-to-slope depth of 400 ft or 122 m, if the in-phase noise envelope does not exceed $\pm 1\frac{1}{2}\%$, i.e. the noise level of the recent survey.

The following table summarizes the depth-of-detection capability of the MaxMin II system for different-sized massive sulphide zones, when using a six-station coil spacing (about 700 ft or 215 m on a steep slope):

* The source of the scaled modelling results is from the writer's personal modelling suite, and from a publication entitled "Type Curves for the Interpretation of Slingram Anomalies etc." Geological Survey of Finland, Report of Investigations No. 1, by M. Ketola and M. Puranen.

** The results over deep conductive sources are shown in a test program report for the MaxMin II system available from Apex Parametrics Ltd., and in a suite of demonstration posters for the MaxMin II system, a copy of which is held by BP Minerals Ltd.

Strike-Length x Depth-Extent	Depth of Detection
≥2000 ft x ≥2000 ft	500 ft
1200 ft x 1200 ft	420 ft
600 ft x 1200 ft	350 ft

These depth figures are now compared with that for the JEM survey of two years ago. It is inherent, with the coil geometry of the latter system, to get a depth of detection of about 0.5 of the coil spacing, when dealing with clean tilt angle data. The noise envelope of the past survey is about $\pm 3^\circ$ (which is equivalent to about a $\pm 5\%$ in-phase noise envelope with a Horizontal Loop system). A noise envelope of $\pm 3^\circ$ would limit the depth of detection of the JEM system to about 0.4 of the coil spacing. Considering that a two-station coil spacing was used with the JEM system, i.e. about 230 ft (70 m) on the slope, then the depth of search for massive sulphide zones was about $0.4 \times 230 \text{ ft} = 95 \text{ ft}$ or 29 m. This depth of detection would not vary for body strike-lengths between 600 ft and 2000 ft, because such strike-lengths are in effect infinitely long for a coil spacing of 230 ft.

THE " $\sigma.t$ " OR CONDUCTIVITY-THICKNESS PRODUCT OF MASSIVE SULPHIDE ZONES

To this point in the report, the expression massive sulphide zone has not been qualified in terms of its $\sigma.t$ value.

The " $\sigma.t$ " of the sulphide lense shown under the "Model Line", in the profile section of this report, is of the order of 1000 mhos, or greater. A $\sigma.t$ value of ≥ 1000 mhos may appear large compared to some of the values seen on maps and in the literature. However, it must be remembered that nearly all published values to date are affected by

phenomena called "current gathering" and "thickness"* , and as a result are much lower than the true values. It generally requires a very low frequency to get clear of the "current gathering" and "thickness" effects, when dealing with a massive sulphide lense in Nature.

Although the lowest frequency (222 Hz) of the MaxMin II system is not generally low enough to be free of the above-mentioned effects, it is lower than most available system frequencies. Nonetheless, with the MaxMin II system, a near "true" value of σt can be obtained by computing a value for each of the four system frequencies, based on interpretive curves from laboratory-scaled modelling with thin sheets in free space. It has been found that such computed values of σt increase as the frequency decreases. By extrapolating to the region of very low frequencies, a reasonably "true" value of σt can be obtained**.

By using the approach described in the preceding paragraph, a "true" σt value was obtained for three well-known volcanogenic massive sulphide bodies of economical value in eastern Canada. The story is told in the following table:

* These phenomena or effects are described with appropriate references on the demonstration posters referred to in the footnote on page 4.

** These procedures are demonstrated on the above-mentioned posters.

Name of Deposit	Location	Type of Sulphides	Thickness of Zone, under test line	"True" σ_t
Le Moine	Chibougamau area	Massive pyrite with sphalerite & chalcopyrite.	4 to 5 meters	3000 mhos
New Inco	Noranda area	Massive pyrrhotite with chalcopyrite.	15 to 17 meters	9000 mhos
Iso (west end)	" "	Massive silicified fine-grained pyrite with sphalerite.	16 meters	50 mhos
Iso (central part)	" "	Same as above on hanging-wall side. Chalcopyrite zone on footwall side.	14 meters 3 meters	1000 mhos

It is apparent from the above table that, where a few-meter thickness of massive (coarse-grained) pyrite, massive pyrrhotite, or massive chalcopyrite is involved, the "true" σ_t values can be quite high, i.e. ≥ 1000 mhos. However, in the case of fine-grained silicified pyrite with sphalerite, the σ_t value can be quite low -- at times substantially lower than the 50 mho value determined for the west end of the Iso sulphide deposit.

Based on the contents of the preceding paragraph, it can be said that the σ_t value of 1000 mhos for the conductive zone under the "Model Line" is not unrealistically high, when considering a chalcopyrite-rich content. Given that a σ_t value of 1000 mhos is realistic, the depth of detection figures, stated in the table on page 5, are also realistic.

For zones containing massive sphalerite (a non-conductor), with little or no associated metallic sulphides, the " σt " can be much smaller than 1000 mhos. However, as long as there is enough metallic sulphide to keep the "true" σt value above 10 mhos, the depth of detection figures will be almost as large at the highest system frequency (1777 Hz) as they will for a 1000 mho conductor. In other words, the amplitude of the in-phase anomaly will be above the in-phase noise envelope at 1777 Hz (but not at the lower frequencies) for a 10 mho sulphide zone at the depths listed in the table on page 5. As the " σt " of the sulphide zone drops below 10 mhos, the in-phase anomaly amplitude at 1777 Hz decreases rapidly, and the sulphide zone must become progressively more shallow than listed in the table on page 5 to be detected by the MaxMin II system.

As far as stratabound massive sulphide zones are concerned, a " σt " of less than 10 mhos means that there cannot be a chalcopyrite-rich layer. Zones of such low σt values would get their conductivity primarily from fine-grained pyrite, and the only chance for economical viability would be in large amounts of sphalerite, possibly with precious metals.

THE CHOICE OF SYSTEM FREQUENCIES

During the reconnaissance phase of a survey, two widespread frequencies are routinely used. The reasons for this are as follows:

- a) The high frequency, through its out-of-phase component, can map very poorly conductive units, which may be of structural significance.

- b) The low frequency, through its in-phase to out-of-phase ratio can indicate the presence of a highly conductive unit at depth, which may not be as apparent at the high frequency due to the strong effect of a near-surface, poorly-conductive unit being superimposed on the deep highly-conductive unit.
- c) The comparative σt estimates at two frequencies can lead to a first order estimate of the true " σt ", and indicate whether the subsequent use of the two additional system frequencies is warranted to get a more accurate estimate.
- d) The comparative depth estimates at two frequencies can lead to a first order estimate of the "true" depth, and indicate whether the subsequent use of the two additional system frequencies is warranted to get a more accurate estimate.
- e) The results at one frequency serve to monitor inevitable reading or recording errors at the other.
- f) Inevitable coil-control errors, computational or otherwise, are pointed out by identical effects on the in-phase readings at both frequencies. Identically unusual in-phase readings are often traced back to an error in the coil-control computations.

The use of a second frequency adds only about 15 to 20% to the overall survey time, because a large percentage of the overall time is spent in travelling to and from the property, and in walking from station to station.

The two frequencies used on the Bap grid are 444 and 1777 Hz.

PRESENTATION OF RESULTS

The MaxMin II profiles, topographic profiles, and the interpreted conductor picture for each line are plotted on special sheets. Reduced-scale copies of these sheets are bound with a "legend" sheet toward the end of the report. Immediately preceding the profiles of the field results is a set of scaled-modelling-based profiles over a deep massive sulphide zone. The latter profiles have already been referred to in the earlier sections.

A plan map showing the grid lines, topographic contours, and interpreted conductive zones, is included in the pocket at the end of the report.

INTERPRETATION OF RESULTS

No sign of massive sulphide zones (nearly-pure sphalerite notwithstanding) is visible in the results. This statement is based on the complete absence of anomalous in-phase results beyond the normal noise-envelope of $\pm 1\frac{1}{2}\%$.

However, there are weakly conductive zones present on the property, as indicated in the out-of-phase results. These zones are listed "A" through "F" on the plan and on the profile sheets.

The dip of the zones shown on the profile sheets is only approximate. However, with exception of zone F, for which there is insufficient data, the dips are probably within 20° of that shown.

Indeed, the most prominent zones are A and C, both of which extend across the entire grid from line 804N to line 828N, with the

exception of a break or grid westward swing in zone C on line 824N.

It is of interest to note that the area bounded by zones A and C contains most of the "rusty" outcrop and talus on the property. There is an indication in the results that zones A and C are not completely isolated zones, but that there is additional poorly-conductive material between them, although, no indication to this effect has been made in the plan or sections.

The exact σt values of the conductive zones are indeterminate, but they are only a fraction of a mho. For this reason, it is felt that they are due to water-filled fractures or shear zones in the pyritized ash tuff units. The water in the shear zones is sufficiently ionized through contact with the pyrite to become EM sensitive. Certainly, the σt values are too small to be due to any kind of interconnectivity between particles or patches of sulphides.

CONCLUDING REMARKS

With the possible exception of nearly-pure sphalerite, there are no massive sulphide zones of economically viable size within 400 ft of surface under the Bap grid. This point should be borne in mind, should any reconnaissance drilling be planned on this grid.

WRITER'S DECLARATION

I have no financial interest in the Bap Group of BP Minerals Limited.

I hold BA and MA degrees in geophysics from the University

of Toronto. I have worked full time in mining exploration geophysics since 1953, and two summer seasons prior to 1953.

All statements made in this report are correct to the best of my knowledge.

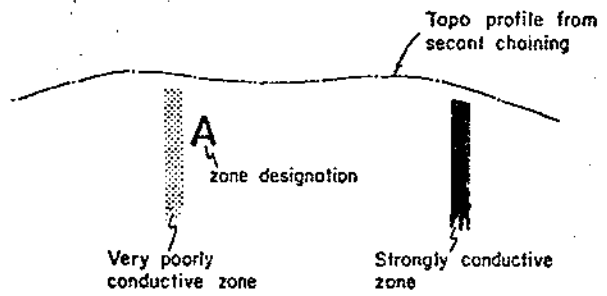
August, 1976
Toronto, Ontario

John E. Betz, M.A., P.Eng. Ont.
John Betz Limited

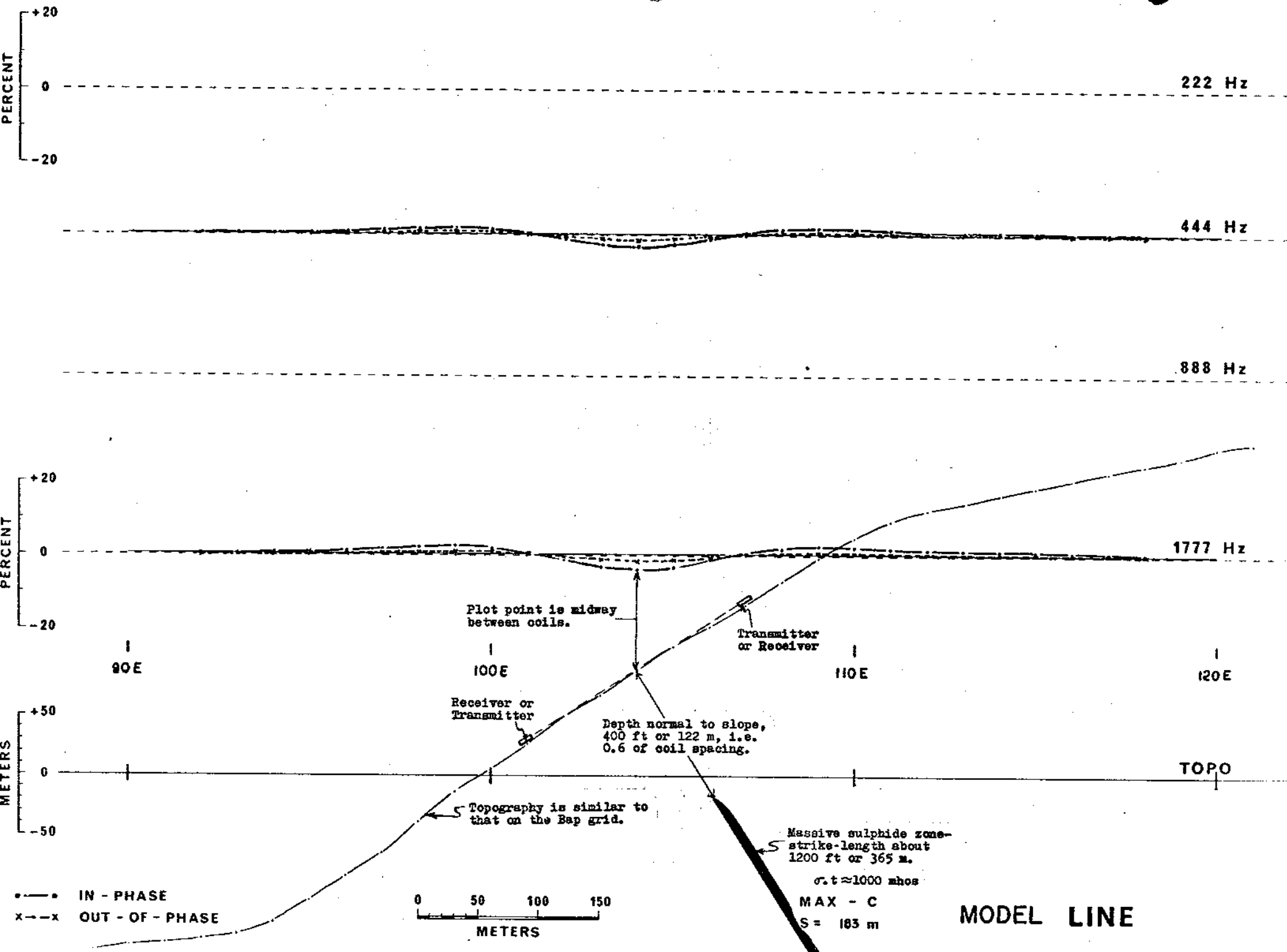
John E. Betz, P. Eng.

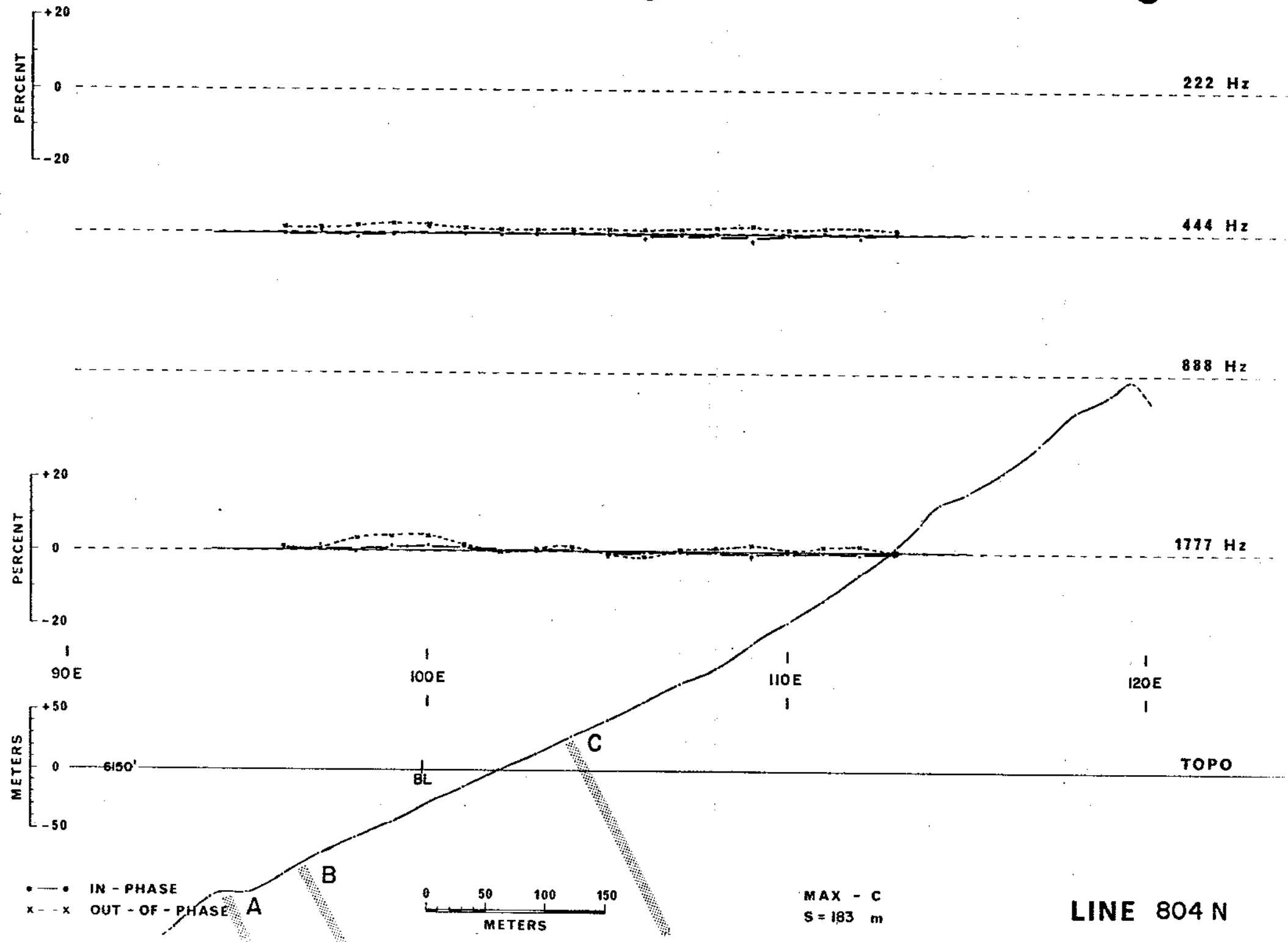


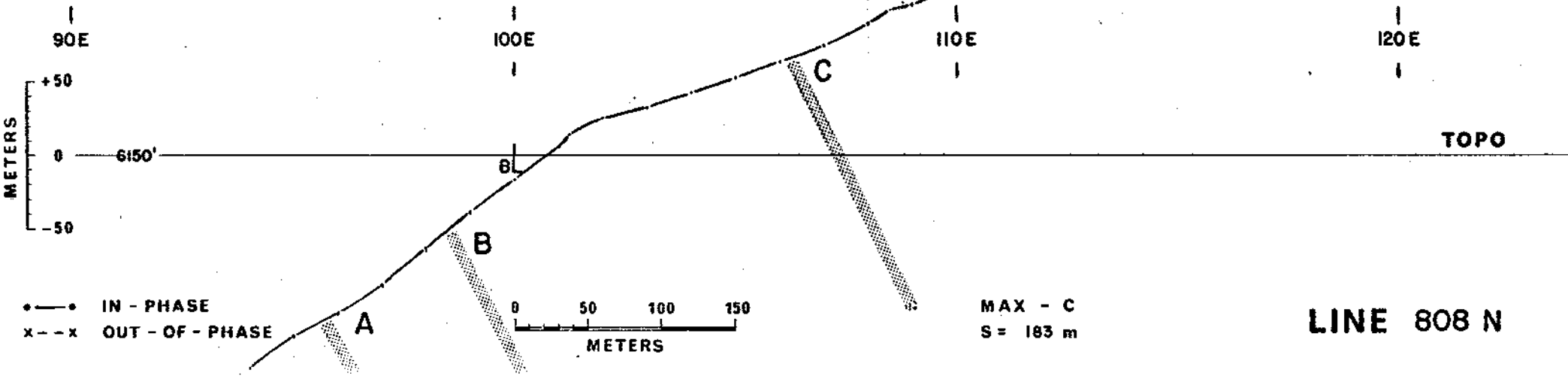
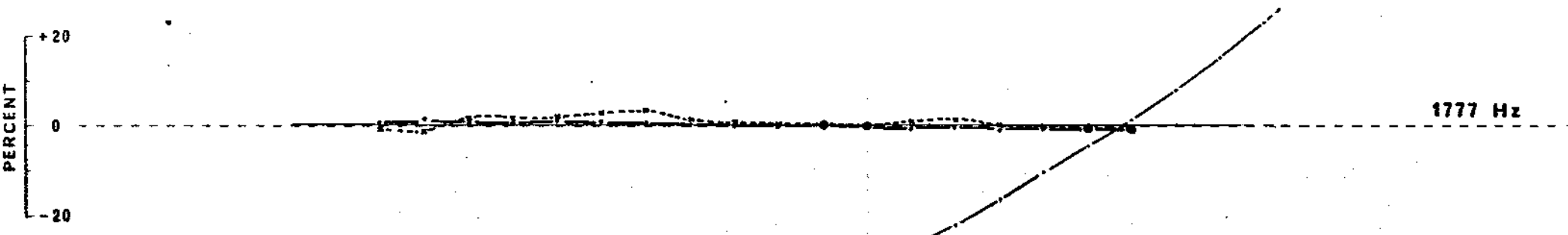
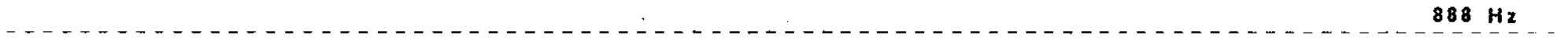
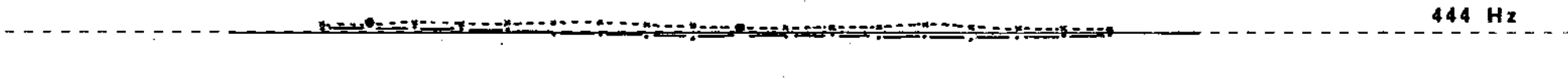
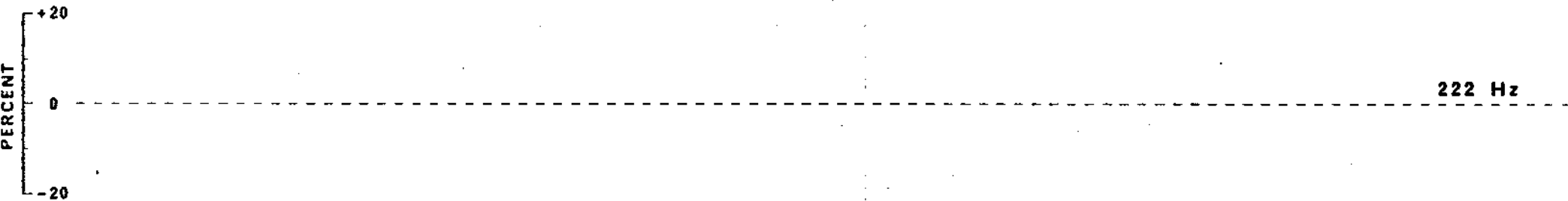
LEGEND FOR PROFILE SHEETS

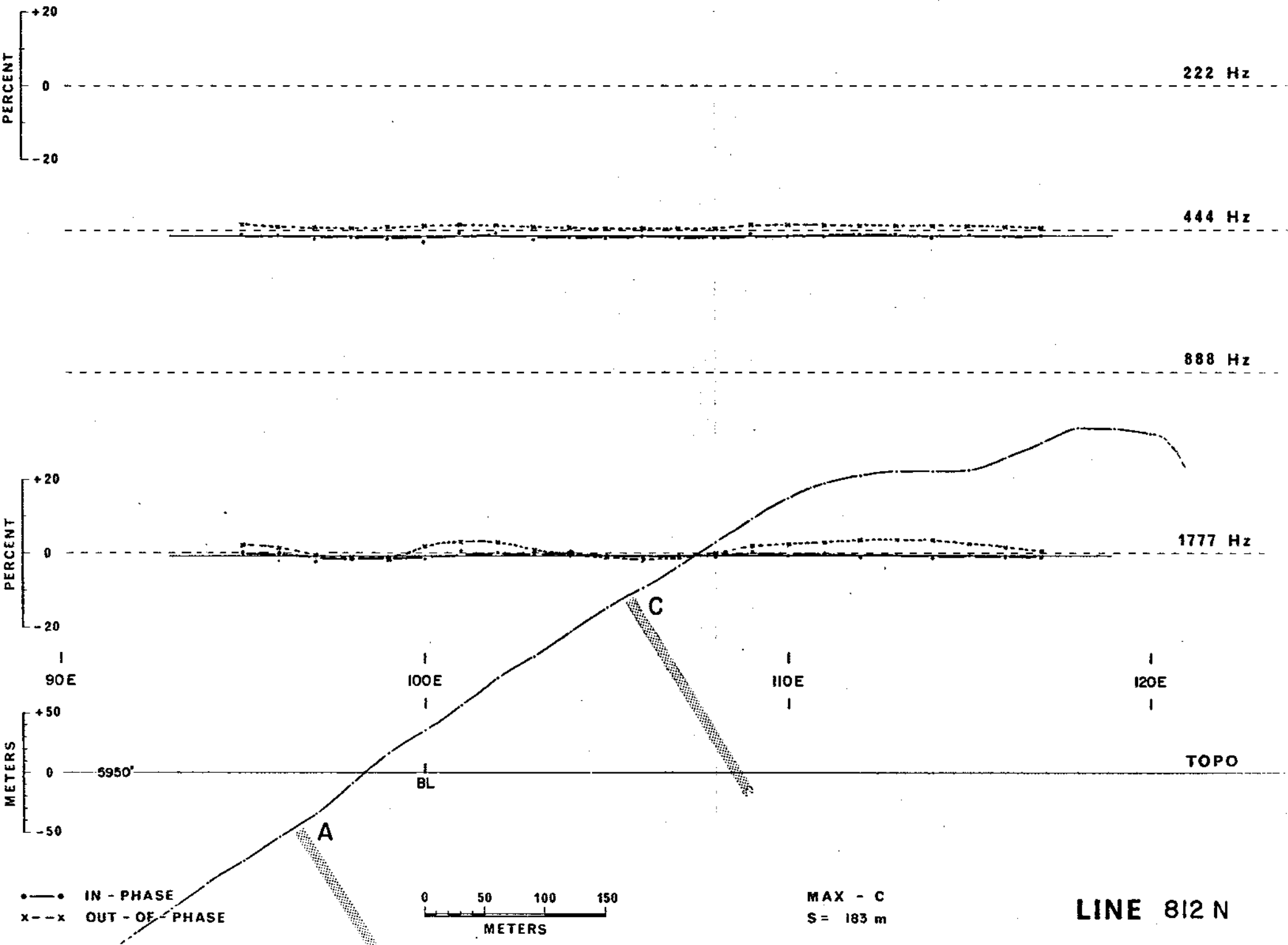


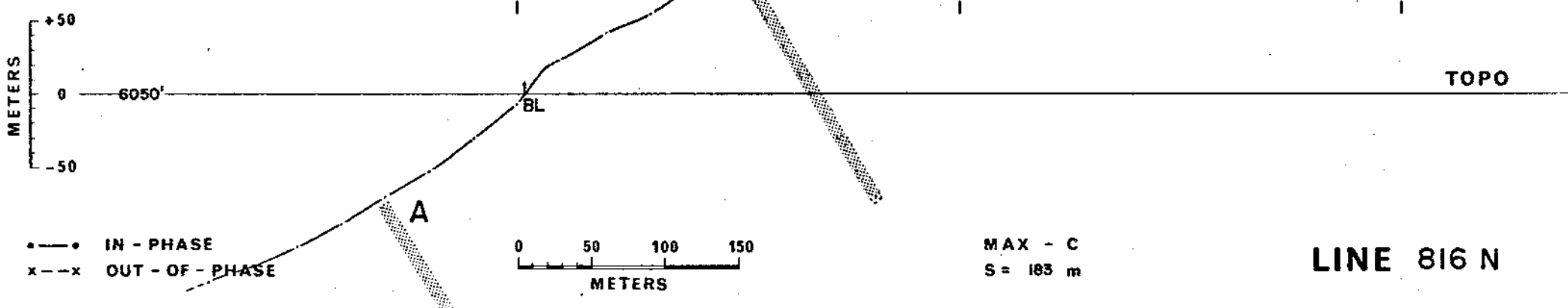
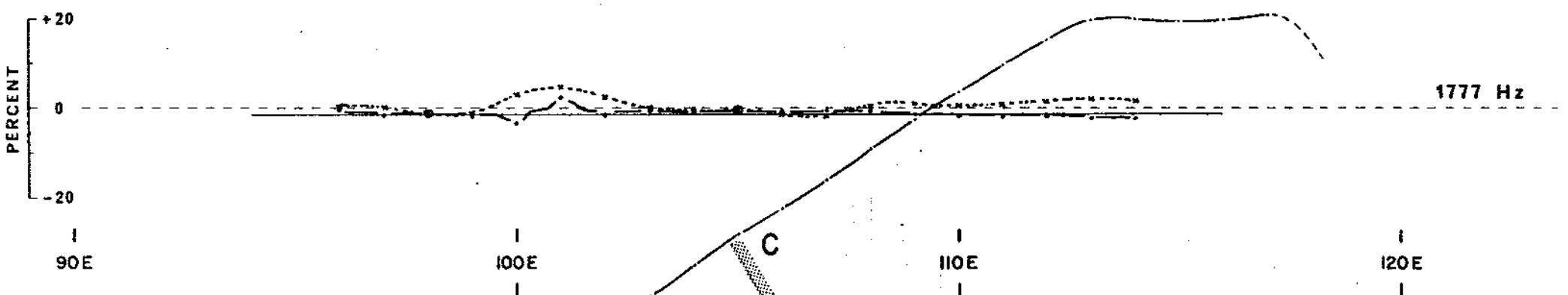
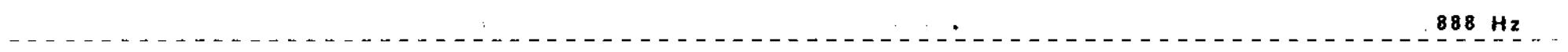
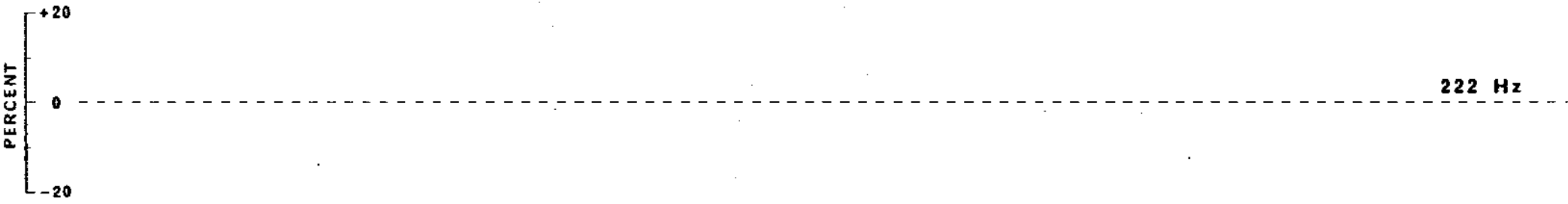
S - system coil spacing, 600 ft or 183 m.
(horizontal plane projection)

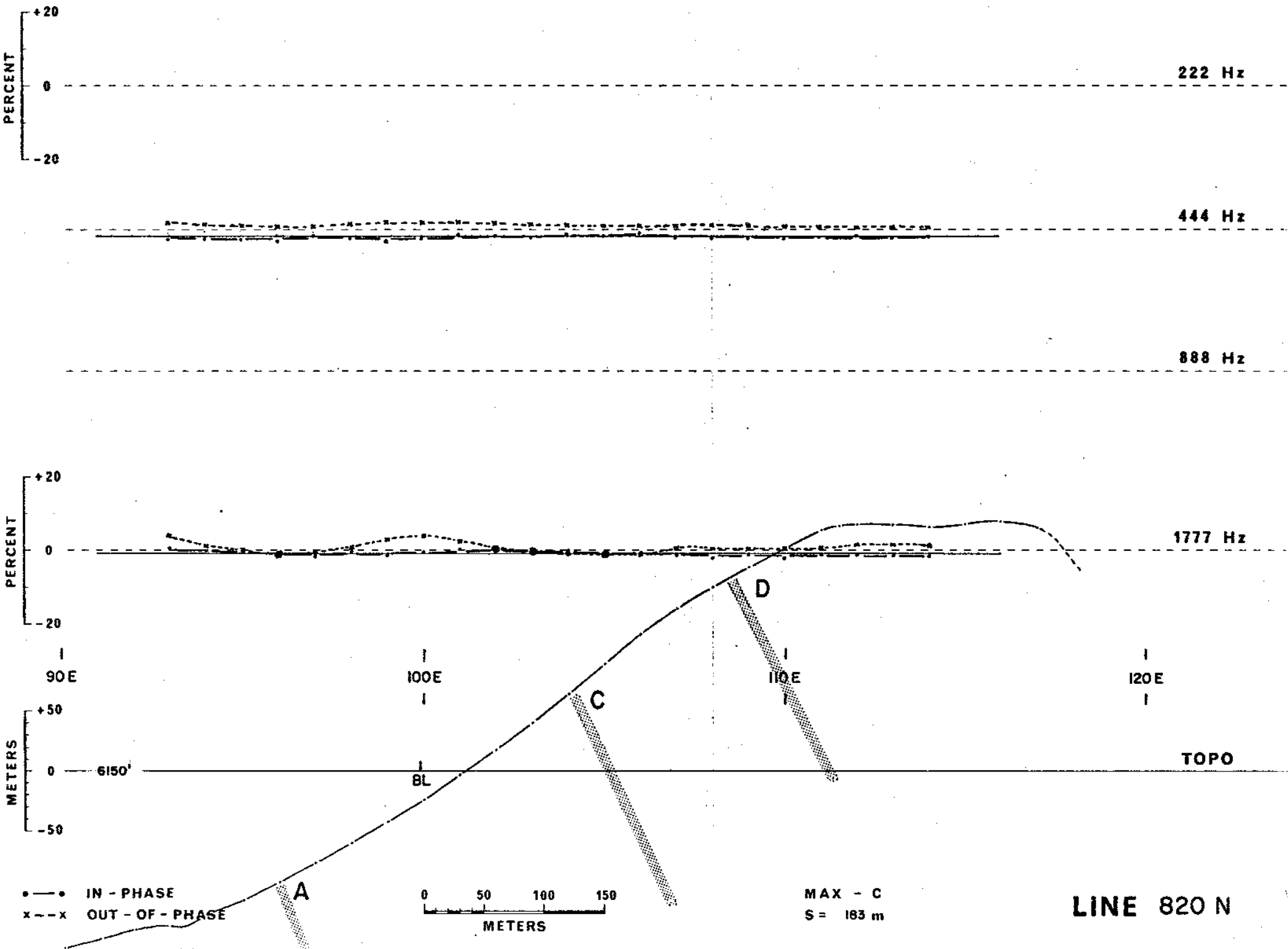


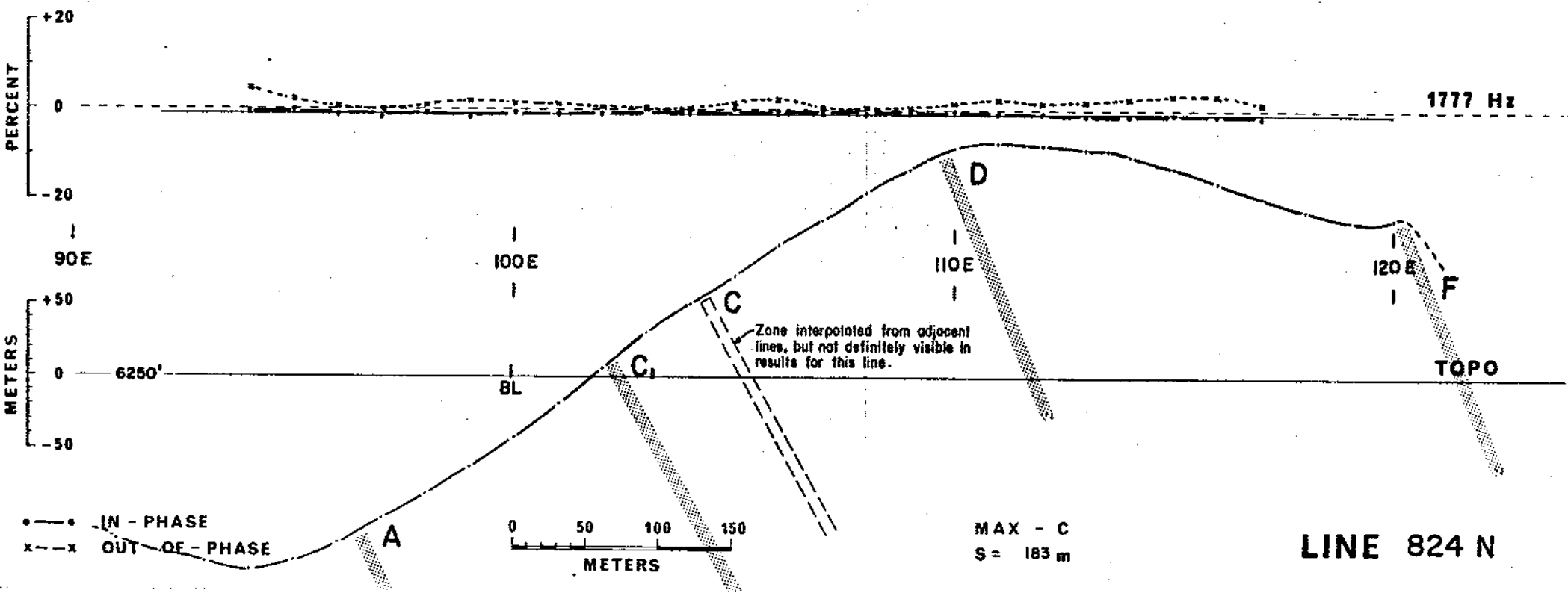
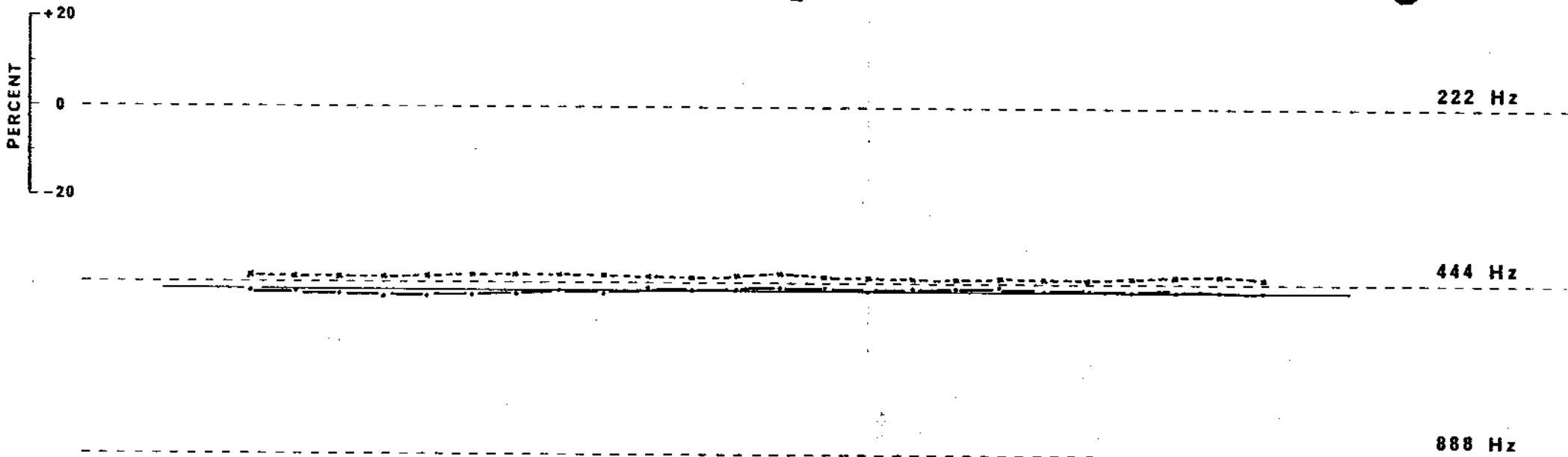


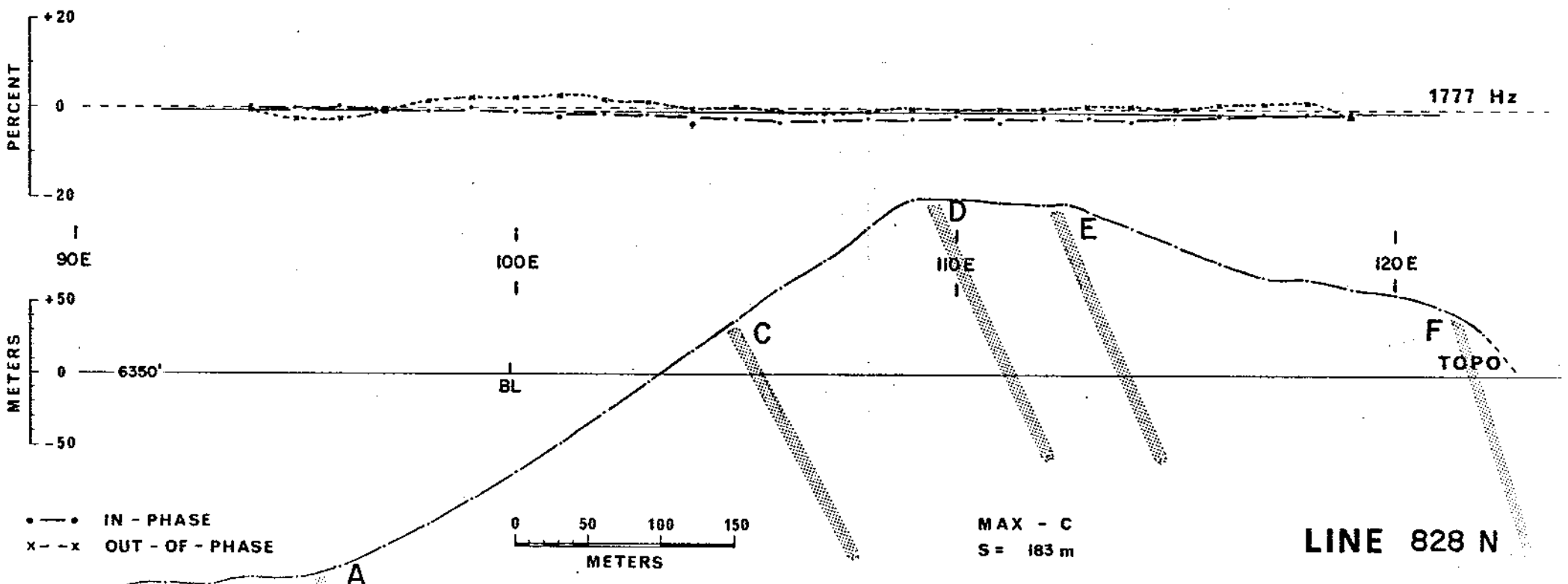
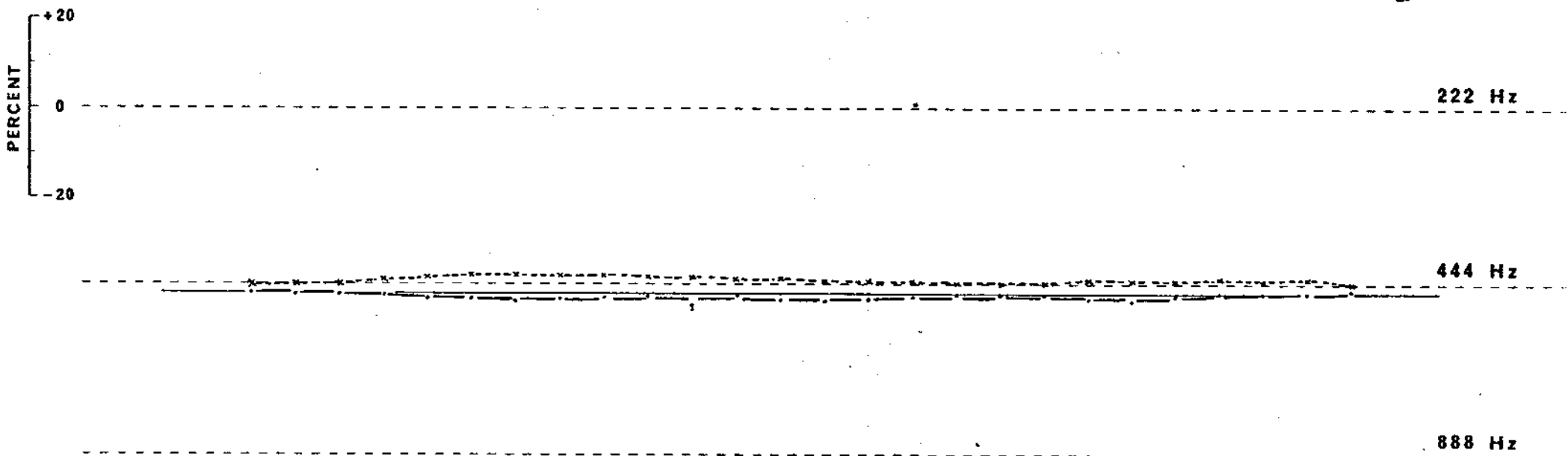


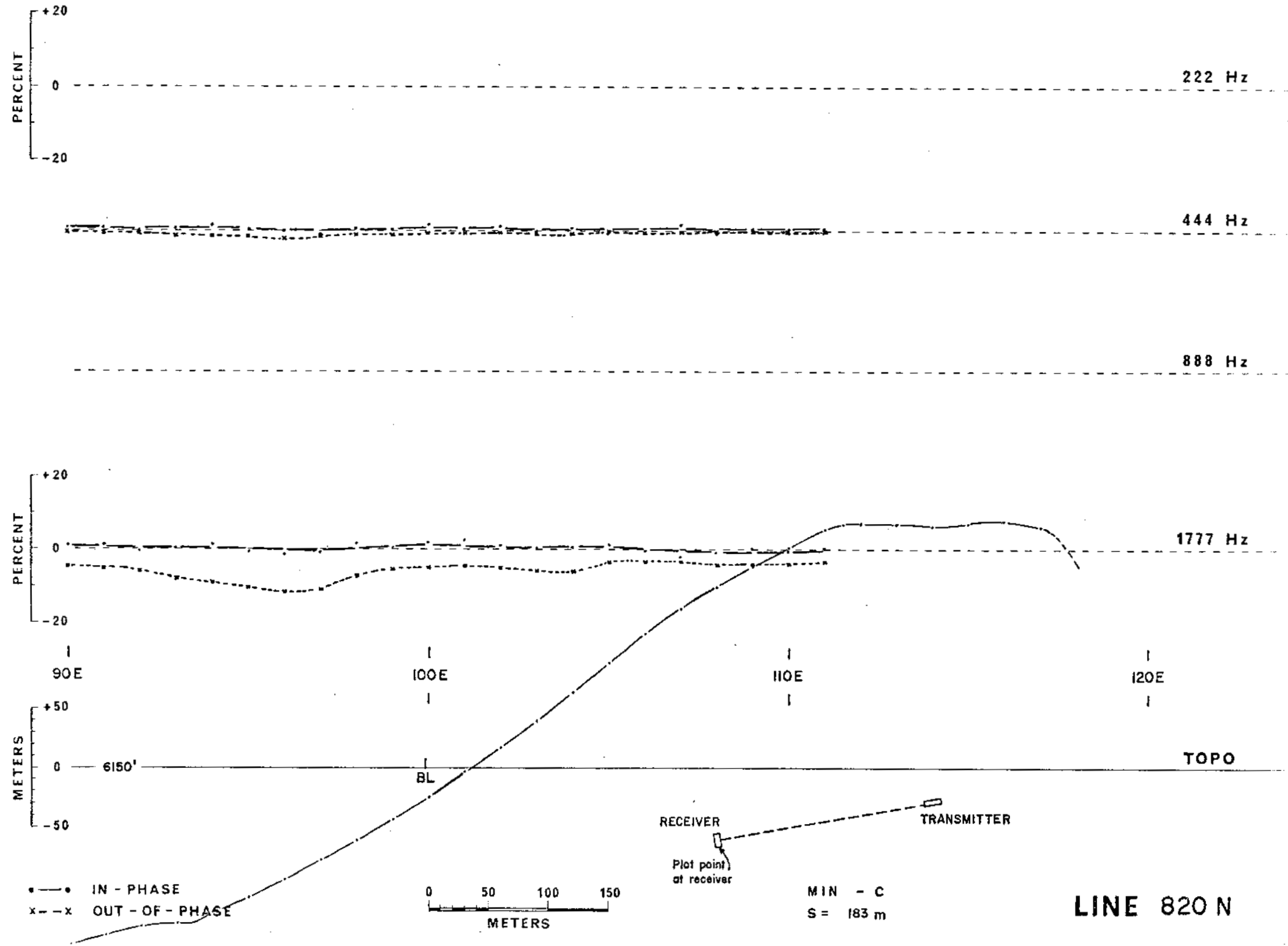


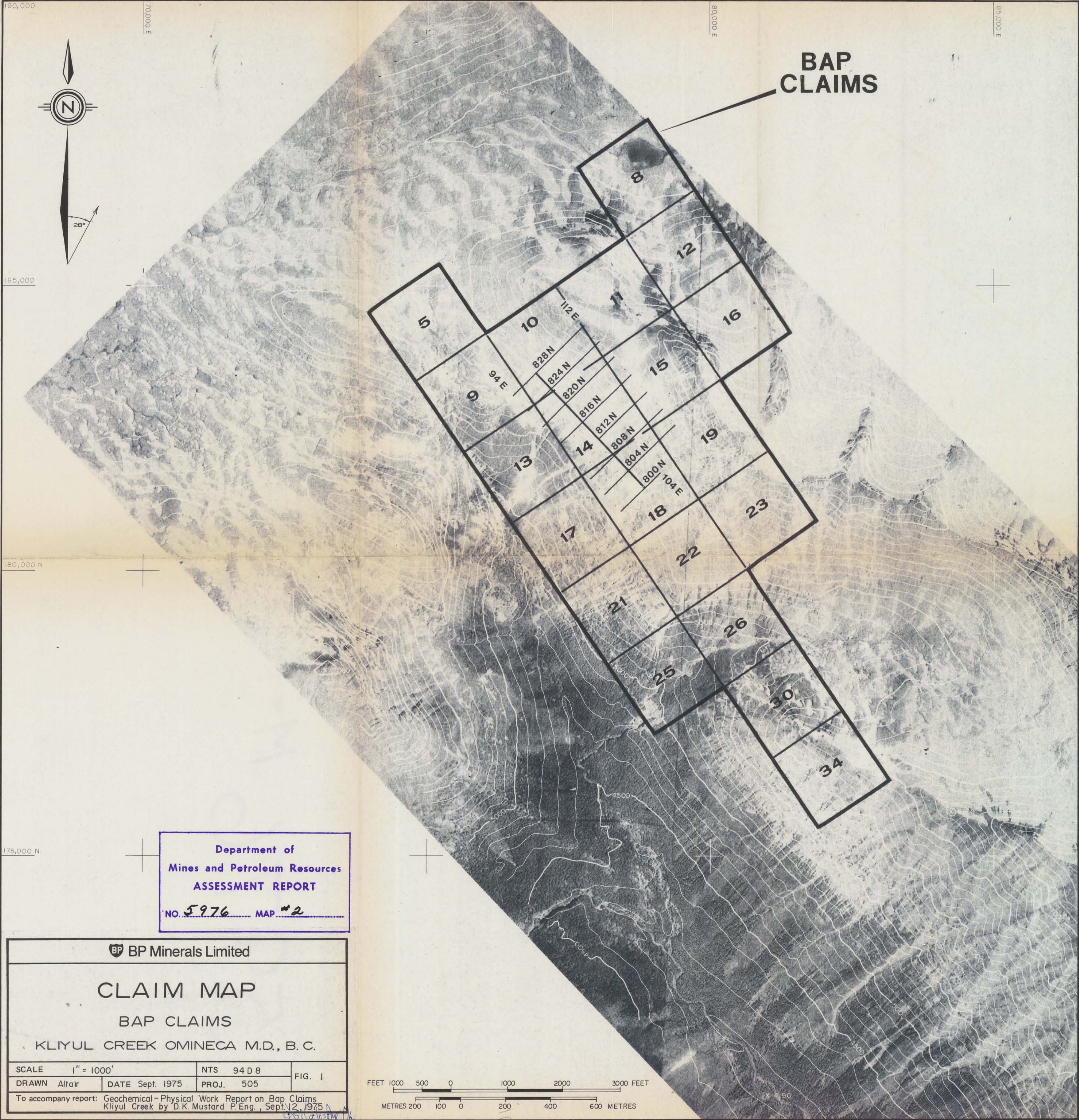


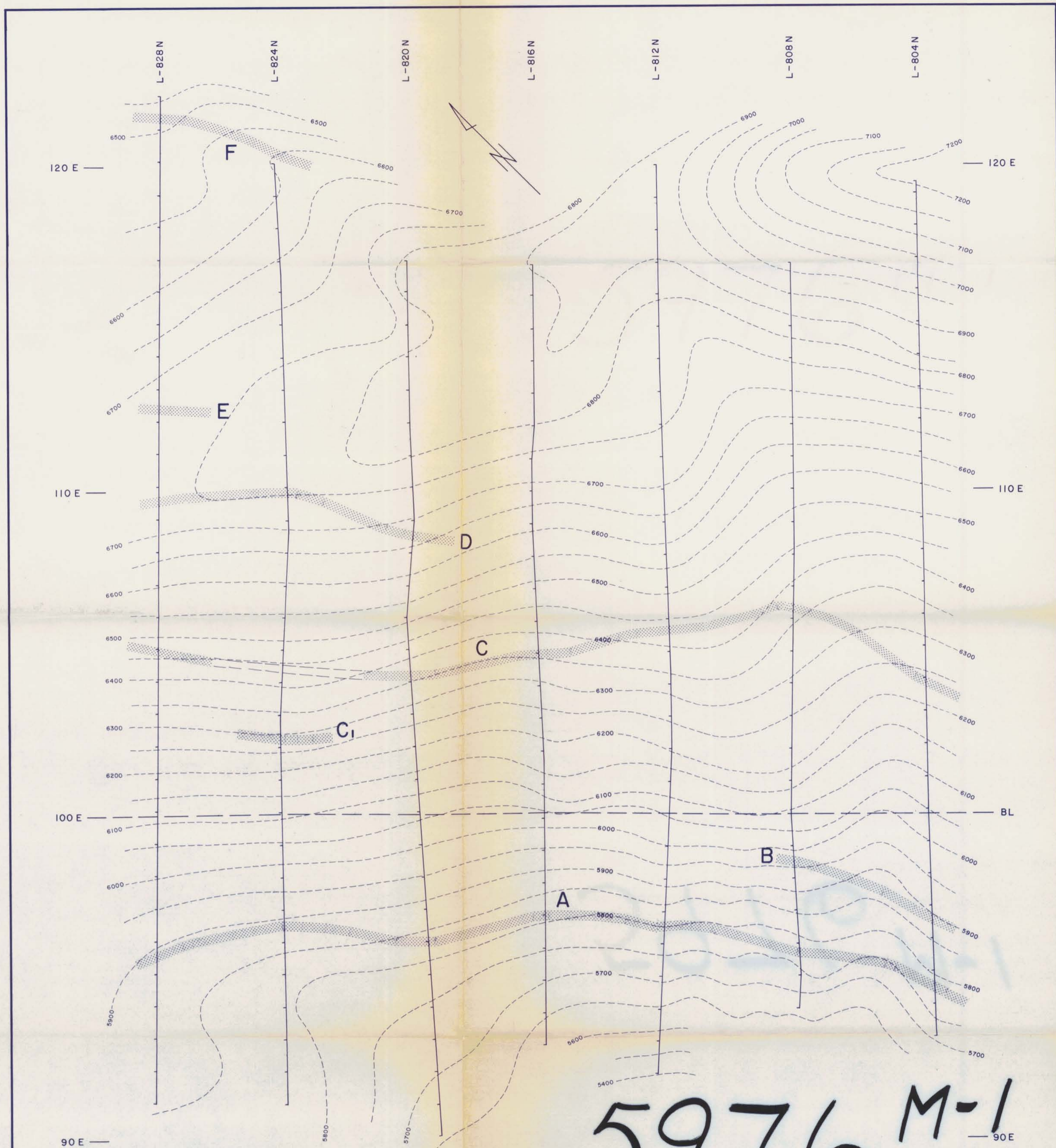












5976 M-1

BP MINERALS LIMITED

BAP CLAIM GROUP



KLIYUL CREEK AREA

OMINECA MINING DIVISION, B.C.

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT

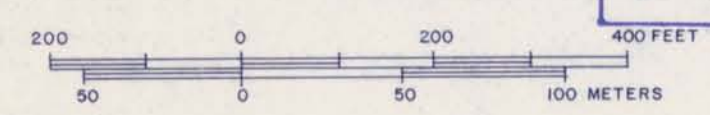
NO. 5976 MAP #1

LEGEND

-  Very poorly conductive zone.
-  5000 Topo contour - interval 50ft. (15.25m)



John E. Betz, P. Eng.



JOHN BETZ LTD.

TO ACCOMPANY REPORT OF
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