827159

REPORT
ON
DATA PROCESSING
OF
SICKER MOUNTAIN MAGNETIC DATA
FOR
CORPORATION FALCONBRIDGE COPPER

REPORT

on

DATA PROCESSING

of

SICKER MOUNTAIN MAGNETIC DATA

for

CORPORATION FALCONBRIDGE COPPER

Toronto, Ontario
May, 1984

Simon J. Bate, M.Sc.
MPH CONSULTING LIMITED

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES

(continued)

SUMMARY

An airborne survey was flown by Dighem Limited of Toronto, Ontario for Corporation Falconbridge Copper, Vancouver, British Columbia over the latter's Sicker Mountain property.

The airborne data was levelled and a total field magnetics map produced at a scale of 1:10,000.

Following this, MPH Consulting Limited of Toronto, Ontario were contracted to reduce the total field magnetic data to a magnetic susceptibility map. The advantages and limitations of the magnetic susceptibility maps obtained are detailed in the report. It was hoped that, from these computer generated presentations, Corporation Falconbridge Copper would be able to extract additional geological information.

Two magnetic susceptibility maps, at a scale of 1:10,000 have been generated. Due to the minimal regional content in the power spectrum of the magnetic data and the uncertainty in isolating it, no attempt was made to remove any regional contribution from the data in preparing the first map. We were unhappy with the results, however, so a regional gradient, approximated by a first order regression, was removed from the data in creating the second map. The first order regression was used due to the minimal regional content of the power spectrum and the uncertainty of the lithologic continuity in the area.

Prior to creating the maps, parameters, such as the degree of low-pass filtering and downward continuation, to be specified in the process were determined by applying various filters to sections of the data. The characteristics of these filters and their effects on the data are discussed in the report.

Severe powerline noise had to be deleted from the total field magnetics and a low pass filter applied to reduce the masking effects of culture and random noise.

No attempt has been made by MPH Consulting Ltd. to interpret the data.

1.0 INTRODUCTION

During November, 1983, Dighem Limited of Toronto, Ontario completed a program of airborne electromagnetic and magnetic surveying on behalf of Corporation Falconbridge Copper of Vancouver, British Columbia on the latter's Sicker Mountain project. The property is located in the Duncan area in the southern portion of Vancouver Island.

The flight data is stored on flight tapes DL0175 and DL0183 prepared by Dighem Ltd. The total field magnetic data, together with the calculated magnetic susceptibility maps, is stored on a magnetic archive tape at MPH Consulting Limited.

The object of this report is to produce a magnetic susceptibility map from the total field magnetic field. The procedures employed are outlined in the body of this report.

Parameters used in applying the filters are:

Strength of the ambient inducing magnetic field	56,400 nT
Inclination of the induced field	70.2° north
Declination of the induced field	20° 15' east
Orientation of the grid axes with respect to true north	19° east of north
Average depth to bedrock sources	1.75 grid cells or 45 metres

2.0 MAGNETIC SUSCEPTIBILITY MAPPING

The extraction of meaningful geological information, in both a qualitative and quantitative sense, from total field magnetic data is a highly skilled undertaking which can take a considerable amount of time. The interpretative model will be updated as more geological information becomes available. A cycle of input and deduction is therefore maintained until a satisfactory geological model is obtained.

As a prerequisite, magnetic interpretation calls for some knowledge of the rock units contained within the area of interest and their probable lithologic setting. Previous experience is also an asset as a number of factors combine to complicate the overall picture presented by the magnetic data.

A few factors to be taken into account are:

i) the physical dimensions of the rock units are as influential as their magnetic properties in determining the strengths of their resultant magnetic anomalies. In other words, the anomaly amplitudes taken by themselves, are not good indicators of magnetic mineral concentration.

ii) the gross distribution of magnetic minerals within any given rock unit is influenced not only by processes which took place during emplacement, but also by subsequent events. Therefore, a rock unit may contain several phases of magnetization.

iii) when the magnetic measurements are taken at a considerable distance form the sources, as in airborne surveys, weak anomalies are suppressed and stronger ones broadened. The resulting overlap badly degrades the resolution.

A number of tools are available to the interpreter to maximize the information gleaned from the data: colour maps, shadow maps, characteristic curves, 2-D and 3-D computer based interpretation methods and various filtering operations. The physical dimensions and attitudes of individual rock units and susceptibility contrasts between units can be determined using these aids.

There is only one process, however, which will directly indicate the relative magnetic mineral content of the rock units over the whole survey area. This and other advantages in magnetic susceptibility mapping are discussed below.

The survey data must first be formatted into a grid file. Next, in order to avoid a confusing three-dimensional picture of apparent susceptibilities, the regional content of the frequency spectrum (see Section 3.2) should be removed from the magnetic data. Near-surface sources will then predominate in the final map.

Subsequent susceptibility filtering will process the data directly into contour maps of variations in apparent magnetic susceptibility levels of rocks at, or close to, the bedrock surface (the bedrock surface is taken to be the magnetic basement).

In performing the operation an inherent downward continuation of the data from the measurement plane to bedrock surface is involved (see Section 3.2). The result is more information content from deep-seated structures, the enhancement of higher frequency, near-surface responses and, therefore, better resolution of overlapping anomaly patterns.

The operator used on the gridded survey data, to produce the susceptibility map, is the inverse of the total magnetic field anomaly due to a square-ended, vertical-sided prism.

The top of the prism is taken to lie at the bedrock surface and the bottom at an indeterminate depth. The apparent magnetic susceptibilities of the prisms are then used to indicate the distribution of ferromagnetic minerals within the bedrock. The surface dimensions of the prism are taken to be a square grid cell where a grid cell side is 1/10 of the map scale. The amount of detail therefore depends to a large extent on the fineness of the grid used in the inversion. In this case, the map is at a scale of 1 inch to 10,000 giving a grid cell of about 25 m by 25 m.

Finally, a number of limitations to the method should be noted:

i) remanent magnetization is not accounted for. If remanence occurs, it can be observed as limited areas of negative magnetic susceptibilities with well-defined boundaries.

ii) there is no allowance for dip. Dipping strata may give rise to bands of negative susceptibility values on the footwall side of the main positive features.

iii) at the edges of strongly magnetic bodies, the magnetic susceptibility is likely to change by up to 2 or even 3 orders of magnitude over one grid cell interval (see Section 3.2). The filtering process will then be unstable, resulting in a halo of negative susceptibilities surrounding or flanking, strongly positive features (vice versa if the rock unit has an inherent negative magnetic susceptibility). With care, a damping function can be used to contain this effect.

In conclusion, a magnetic susceptibility map is a representation of the magnetic mineral content of the rock units rather than the amplitudes of their individual anomalous responses. With due consideration to the limitations of the processing, the method could provide a more accurate basis for extending geological mapping beneath non-magnetic cover and/or into unmapped regions.

3.0 PROCEDURES AND RESULTS

3.1 Selection of Test Areas

In order to minimize computing costs, and for faster interaction with the computer, two sections of the survey area were used to test the filters (Figure 1). The total field magnetic contours of the survey area are displayed in Figure 2.

Area A was selected to test for the minimizing of severe powerline noise within the data. Other powerlines on the property appear to have had minimal effect.

Area B was selected from a largely noise-free section to determine the regional contribution to the data and to estimate the degree of downward continuation that could be applied.

3.2 Filters

Filters allow one to selectively enhance, suppress, extract or delete information within the spectral content of a dataset.

The filtering operations performed on the above areas included spectral analysis, elliptic filtering, downward continuation and pole reduction.

The filters were applied interactively to the test areas using a Tecktronix interfaced with the Vax mainframe computer at Dataplotting. The effects of these filters are outlined below.

i) Loglinear matched filter: used to obtain the power spectrum of a given area. The low and mid-frequency slopes of the spectrum are used to find the regional magnetic effect (Figure 3).

Residual plots are constructed by subtraction of the regional effect from the original data.

ii) Elliptic pass filter: biases the data in a direction chosen by indicating the angle offset clockwise from the positive X axis in conjunction with the cutoffs in directions X and Y. The result can be low or high pass filtered.

iii) Downward continuation: enhances the resolution of weak anomalies. More information is revealed about deep-seated (basement) structures, near-surface high frequency anomalies are sharpened and the resolution between overlapping anomaly patterns increases.

The degree of continuation is specified in grid cells; one grid cell having the dimensions of one tenth of the horizontal scale of the raw data. In this case, one grid cell is approximately 25 m by 25 m.

Downward continuation can be useful in gauging the average depth to magnetic basement for the following reasons.

Due to the assumptions on which the integral defining the continuation is based, there is no valid solution for any continuation beneath the magnetic basement. The solution will begin to oscillate and diverge. This phenomenon can be observed as "ringing" in the higher frequencies of the power spectrum of the filtered data.

One particular factor, however, can lead to errors in this estimate. If there is a large degree of high-frequency near-surface content in the data, then the convergence of the solution to the integral will be curtailed. The result will be an apparent depth to magnetic basement which is, in reality, too shallow. Application of a mild low-pass filter is therefore recommended before downward continuing the data in this case.

iv) Pole reduction: eliminates the effect of location, with respect to magnetic north, on the data. Magnetic highs and lows are centered over their sources.

NOTE: It should also be noted that, if too coarse a grid is used in generating a magnetic susceptibility map, the exaggerated size of the prisms used in the inversion will give rise to an effective smoothing of the data.

3.3 Test Areas

3.3.1 Area A

The total field magnetic contours of Area A are displayed for comparison in Figure 4.

The section extracted from the survey data contains severe powerline noise. For convenience, the power-line locations are highlighted with a dashed red line on relevant figures.

The filters used on this test area included spectral analysis which was used in obtaining the regional and residual maps, elliptic pass filters and combinations of downward continuation, spectral analysis and elliptic filtering. The parameters used in individual filters are listed in Table 1.

The effectiveness of the various filtering operations applied to minimize the powerline noise are described below:

i) The power spectrum of the area is shown in Figure 5. The regional content of the spectrum is very small.

ii) The regional map (Figure 6) calculated from the spectrum shows that a significant portion of the powerline noise is of low frequency.

iii) Elliptic low pass filters with cutoffs at 0.2 Hz, 0.05 Hz and 0.02 Hz were applied in an effort to minimize the powerline signature (Figures 7, 8 and 9). The net effect is to filter out both the noise and the anomalous zone directly north of the powerline.

iv) Downward continuation of the data will sharpen an anomaly as the source's datum level is approached: that is, enhance the higher frequency content, allowing for a more efficient low pass filter operation.

For a nominal data acquisition height of 50 m above the ground, the maximum possible number of grid cells of downward continuation before instability occurs should be approximately two, due to a grid cell size of 25 x 25 m and the magnetic sources being close to, or at, surface.

The power spectrum after downward continuation by one grid cell (Figure 10) displays an increased high frequency content. A subsequent low pass filter applied at 0.2 Hz shows negligible effect on the noise data however (Figure 11).

v) Instability is encountered on downward continuing by 2 grid cells (Figure 12), as the "ringing" in the power spectrum indicates.

The conclusions drawn from these filtering operations is that the powerline noise could not be muted without producing significant distortions in the remaining data.

If the powerline noise were to be left in, the magnetic high immediately to the north would be distorted during the susceptibility mapping process.

Therefore, to minimize its effect, the relevant noise data was removed, leaving a wedge of zeros across which the various computational methods were interpolated.

3.3.2 Area B

The total field magnetic contours of Area B are displayed for comparison in Figure 13.

Determination of the regional contribution to the data and the average depth to magnetic basement is discussed below.

i) The power spectrum of the area (Figure 14) shows an overall higher frequency content than that of Area A. The regional content of the spectrum, as in Area A, is very small.

ii) Two attempts to separate the regional effect of the spectrum of Area B were made using slightly differing slopes.

Two very different apparent depths to regional sources of 18 (Figure 14) and 44 (Figure 17) were obtained. The resultant regional maps (Figures 15 and 18 respectively) also show a different frequency content. In both cases, the regional map appears to be a "washed out" facsimile of the total field magnetics (Figure 13).

Figure 16 is the residual map obtained after removing the regional magnetic sources illustrated in Figure 15.

iii) Due to the large degree of culture within the property, it was anticipated that a low-pass filter would have to be applied to the data so as to minimize its masking effect. Figure 19 displays the power spectrum of the data after a fairly severe low-pass filter (cutoff at 0.14 Hz) has been applied. The high frequency content of the spectrum is significantly reduced.

iv) A further problem was determining the degree of downward continuation that could be applied to the data. Figures 21 to 23 demonstrate the increasing high frequency content of the data with greater downward continuation applied to the raw data. The minimum continuation applied, 1.3 grid cells or 33 metres, shows unacceptable "ringing" in the spectrum (see Section 3.2).

Figures 24 and 25 demonstrate that a greater degree of downward continuation is possible after low-pass filtering the data.

In conclusion, the data could not be downward continued to a reasonable magnetic basement without first low-pass filtering the data to remove the majority of the high frequency noise. The large topographic variation in the area and the probability that most of the magnetic structures are close to, if not at, surface led to a conservative choice of an average 45 m from survey flight height to magnetic basement.

Removal of any regional effects, such as deep-seated structures and a regional gradient, utilizing the power spectrum was considered suspect due to the minimal regional content in the spectrum and the uncertainty in locating the slope.

3.4 Regression Analysis

The difficulty in removing any regional gradient from the data without producing a distorted residual led to regression analysis of the data. The procedure is to fit a first, second or third order surface to the data, depending on the degree of regression to be applied.

The plane fitted to the data (Figure 26) dips to the south-west.

The quadratic surface (Figure 27), introduces a ridge in the northern third of the area. This is almost certainly due to the coincident magnetic highs in the raw data (Figure 2).

The third order surface presents further evidence for this view (Figure 28). A saddle point is located over a break in the band of magnetic highs, with sharp, almost cusp-like, contours within the zones of magnetic highs to the east and west.

Fitting a second or third order regression to the raw data, in this case, leads to the possibility of creating a continuous east-west band of magnetic highs as well as removing any regional gradient.

The geological map of the survey area, as compiled by Corporation Falconbridge Copper, indicates that a broad band of Sicker volcanics extends the entire length of the survey area.

The magnetic data, however, reveals that the volcanic units are very much narrower than suggested. In addition, the units do not appear to be continuous east-west, even after accounting for the variable magnetic signature expected from the volcanics.

As a result of these observations, it was decided to subtract a first order regression from the magnetic data to remove the regional gradient.

If it is later confirmed geologically that the volcanic units do extend unbroken east-west, then application of a higher-order regression would be justified.

3.5 Susceptibility Map

As a result of the tests on the data, the powerline noise was deleted from the data and two susceptibility maps were compiled as follows:

MAP 1

i) a low-pass filter (cutoff at 0.14 Hz) was applied to minimize cultural and random noise

ii) the data was pole reduced to centre the anomalies over their sources

iii) the susceptibility map was computed using a depth to magnetic surface of 1.75 grid cells or 45 m.

MAP 2

i) a first order regression was fitted to the data and removed as the regional gradient

ii) a mild low-pass filter (cutoff at 0.2 Hz) was applied to minimize the cultural and random noise

iii) the data was pole reduced to centre the anomalies over their sources

iv) the susceptibility map was computed using a depth to magnetic surface of 1.75 grid cells or 45 m.

4.0 CONCLUSIONS

Two magnetic susceptibility maps have been generated from the airborne magnetic data.

Severe powerline noise in the area had to be deleted as filtering techniques were unable to mute it. Unfortunately, some information is lost, but the effects are significantly less than if the noise were to have been left in. High frequency noise, of which culture was a significant portion, also had to be suppressed with low-pass filtering.

In the preparation of the first map, no regional effects were removed due to the uncertainty in isolating them from the remaining spectral content of the data. There is a slight north-south regional gradient which is highlighted by the logarithmic colouring intervals of the magnetic susceptibility plot.

Prior to generating the second map, a first order regression was removed from the total field magnetic data to delete the regional gradient in the data. This was considered preferable to the uncertainty in determining the regional contribution to the data in the power spectrum. Also, a less severe low-pass filter was applied to allow a maximum contribution from the near-surface higher frequency features.

No attempt was made to remove the effects of possible deep-seated anomalies by using a second or third order regression. It has been demonstrated that these would possibly create new anomalies rather than enhance existing near-surface anomalous zones. As a result, due consideration should be given to the probable 3-D nature of the map when an interpretation is being attempted. The limitations of the method, as outlined in Section 2.0, should also be allowed for.

Respectfully submitted,

Simon J. Bate

S.J. Bate, M.Sc.
MPH Consulting Limited

CERTIFICATE

I, Simon J. Bate of Toronto, Ontario, hereby certify that:

1. I hold a Bachelor of Science degree in Physics from the University of Bristol, England and a Master of Science degree in Applied Geophysics and a Diploma of Imperial College from Imperial College, London, England.

2. I have practiced my profession continuously since graduation.

3. I have based my conclusions contained in this report on my previous experience and knowledge of geophysical interpretation techniques.

4. I hold no interest, directly or indirectly in the property other than professional fees, nor do I expect to receive any interest in the property or in Corporation Falconbridge Copper or in any of its subsidiary companies.

Simon J. Bate

Toronto, Ontario
May, 1984

Simon J. Bate, M.Sc.
MPH Consulting Limited

BIBLIOGRAPHY

Grant, F.S. and West, G.F., 1965; Interpretation Theory in Applied Geophysics, McGraw-Hill Book Company

Digital Filtering, User's Guide, Dataplotting Services Ltd.

TABLE 1

AREA A FILTERS

Figure	Filter Type	Filter Parameters	Contour Interval
	matched filter	loglinear filter	
3	power spectrum		
4	regional map		100 nT
5	elliptic filter	Butterworth low pass filter cutoff in X and Y = 5 angle offset = 0° attenuation = 10	100 nT
6	elliptic filter	Butterworth low pass filter cutoff in X and Y = 20 angle offset = 0° attenuation = 10	100 nT
7	elliptic filter	Butterworth low pass filter cutoff in X and Y = 50 angle offset = 0° attenuation = 10	100 nT
	downward continuation & matched filter	1 grid cell loglinear filter	
8	power spectrum		
9	downward continuation & elliptic filter	1 grid cell Butterworth low pass filter cutoff in X and Y = 5 angle offset = 0° attenuation = 10	100 nT
	downward continuation & matched filter	2 grid cells loglinear filter	
10	power spectrum		

<u>TABLE 2</u>

<u>AREA A FILTERS</u>

Figure	Filter Type	Filter Parameters	Contour Interval
	matched filter	loglinear filter	
12	power spectrum		
13	regional map (1)		100 nT
14	residual map (1)		100 nT
15	regional map (2)		100 nT
	elliptic filter	Butterworth low pass filter cutoff in X and Y = 7 angle offset = 0° attenuation = 10	
	matched filter	loglinear filter	
17	power spectrum		
18	regional map		100 nT
	downward continuation & matched filter	1.3 grid cells loglinear filter	
19	power spectrum		
	downward continuation & matched filter	1.5 grid cells loglinear filter	
20	power spectrum		
	downward continuation & matched filter	1.75 grid cells loglinear filter	
21	power spectrum		

TABLE 2
(continued)

Figure	Filter Type	Filter Parameters	Contour Interval
	elliptic filter	Butterworth low pass filter cutoff in X and Y = 7 angle offset = 0° attenuation = 10	
	downward continuation & matched filter	1.75 grid cells loglinear filter	
22	power spectrum		
	elliptic filter	Butterworth low pass filter cutoff in X and Y = 5 angle offset = 0° attenuation = 10	
	downward continuation & matched filter	2 grid cells loglinear filter	
23	power spectrum		

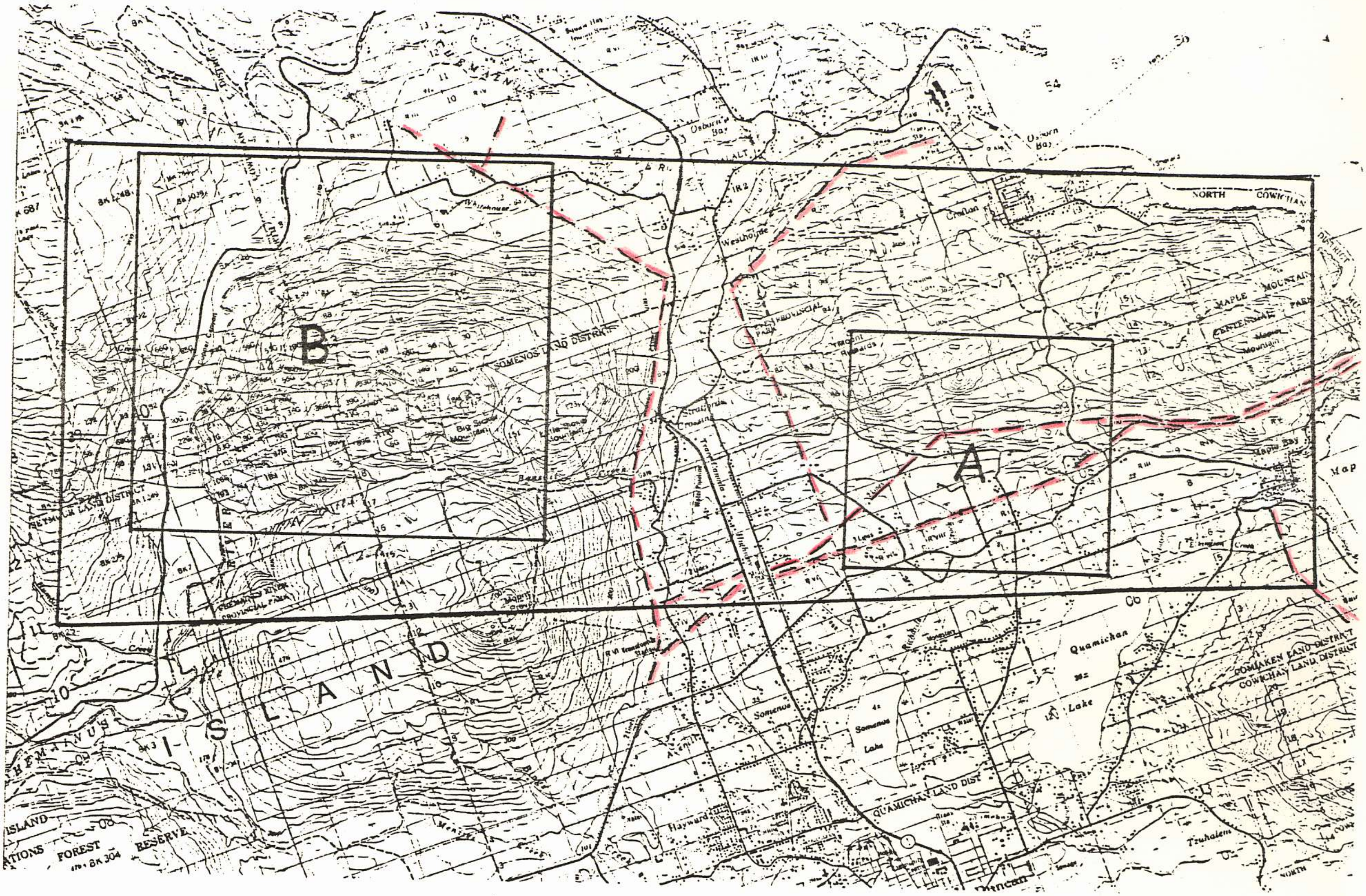


Figure 1: Survey area limits, powerline locations and test areas A and B (scale 1:32,500)

Figure 2: Total Field Magnetic Contours: Survey Area

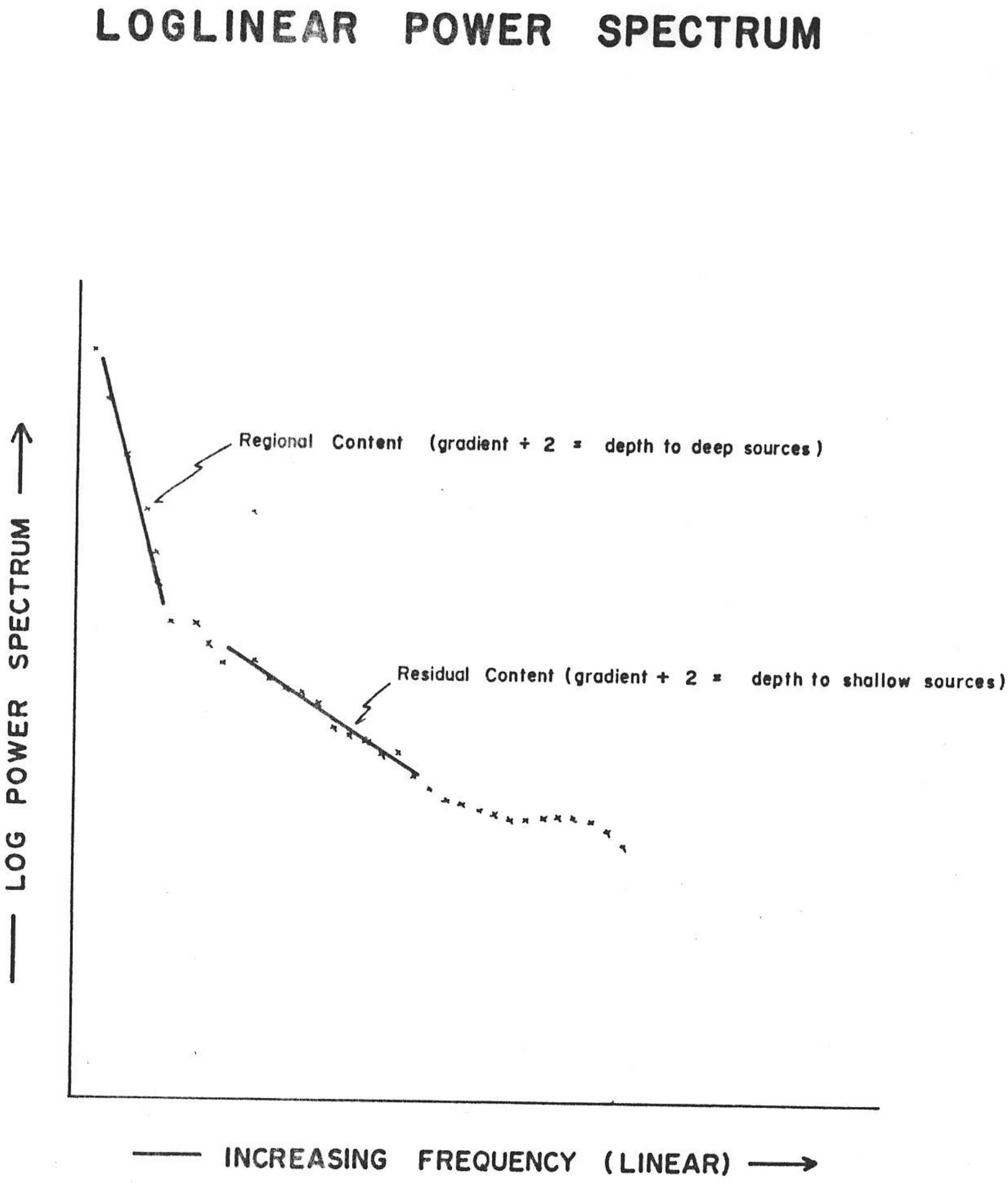


Figure 3: Regional and Residual Contributions to the Power Spectrum

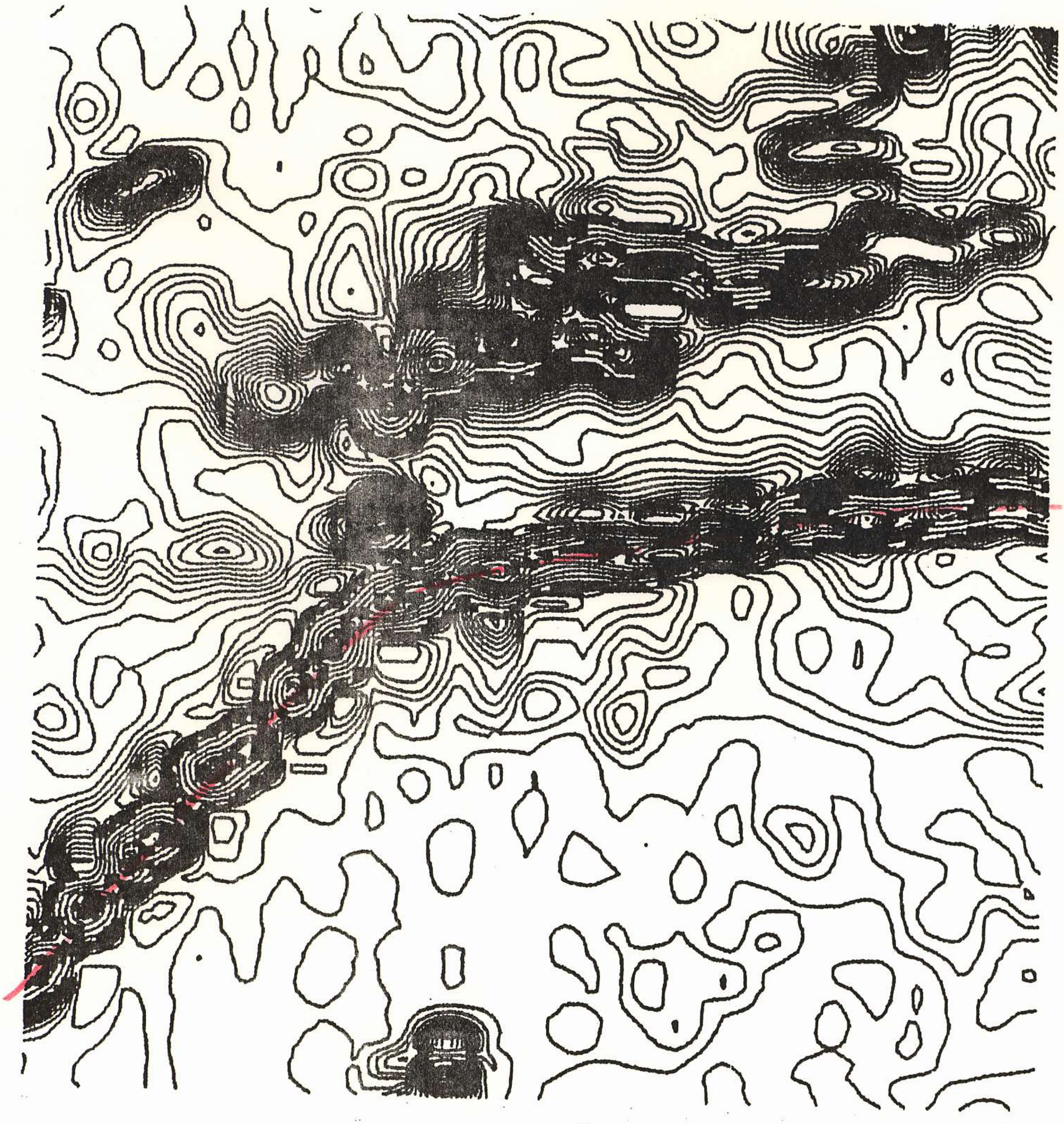


Figure 4: Total Field Magnetic Contours (Contour interval: 100 nT)

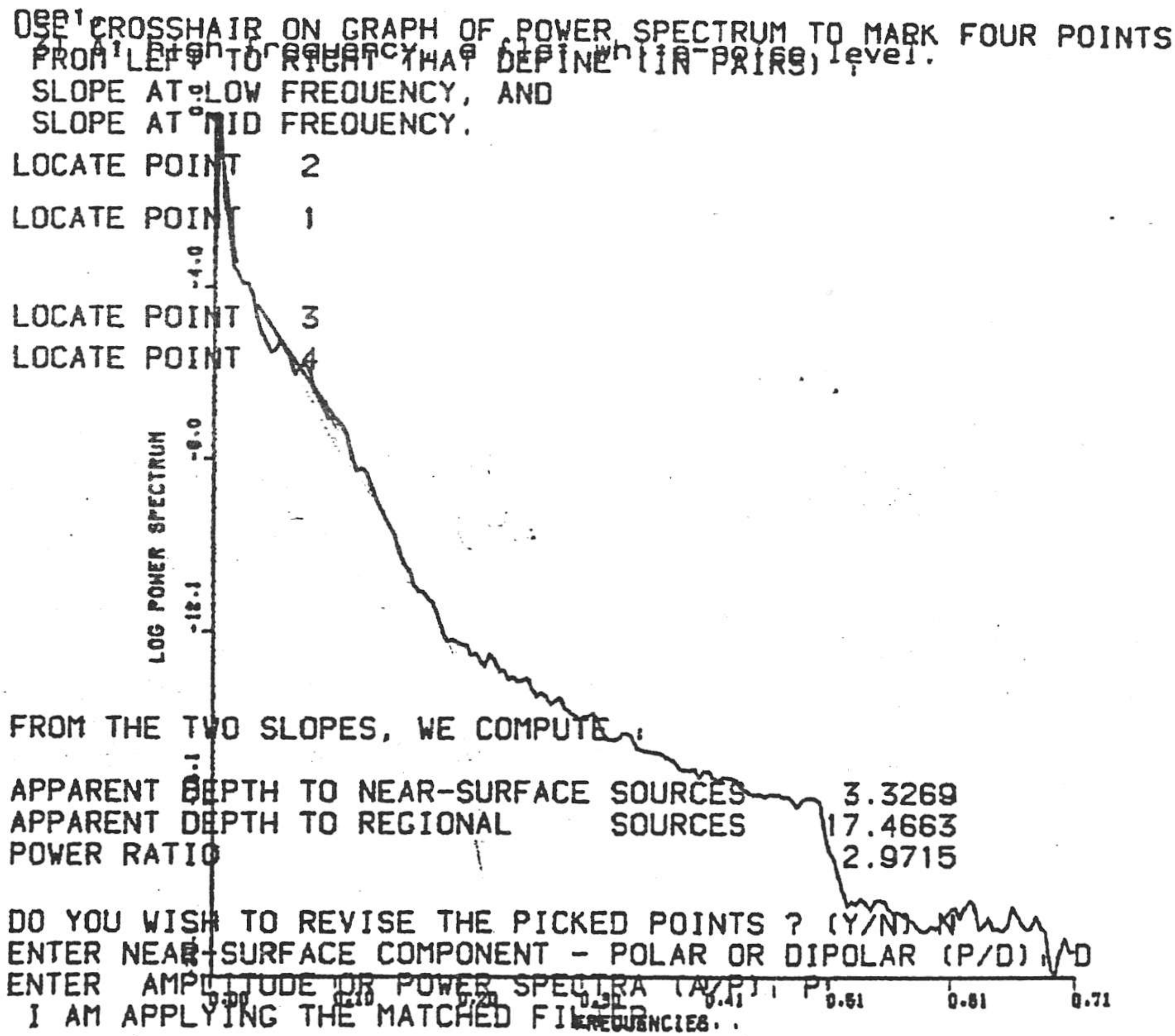


Figure 5: Power Spectrum

Figure 6: Regional Map

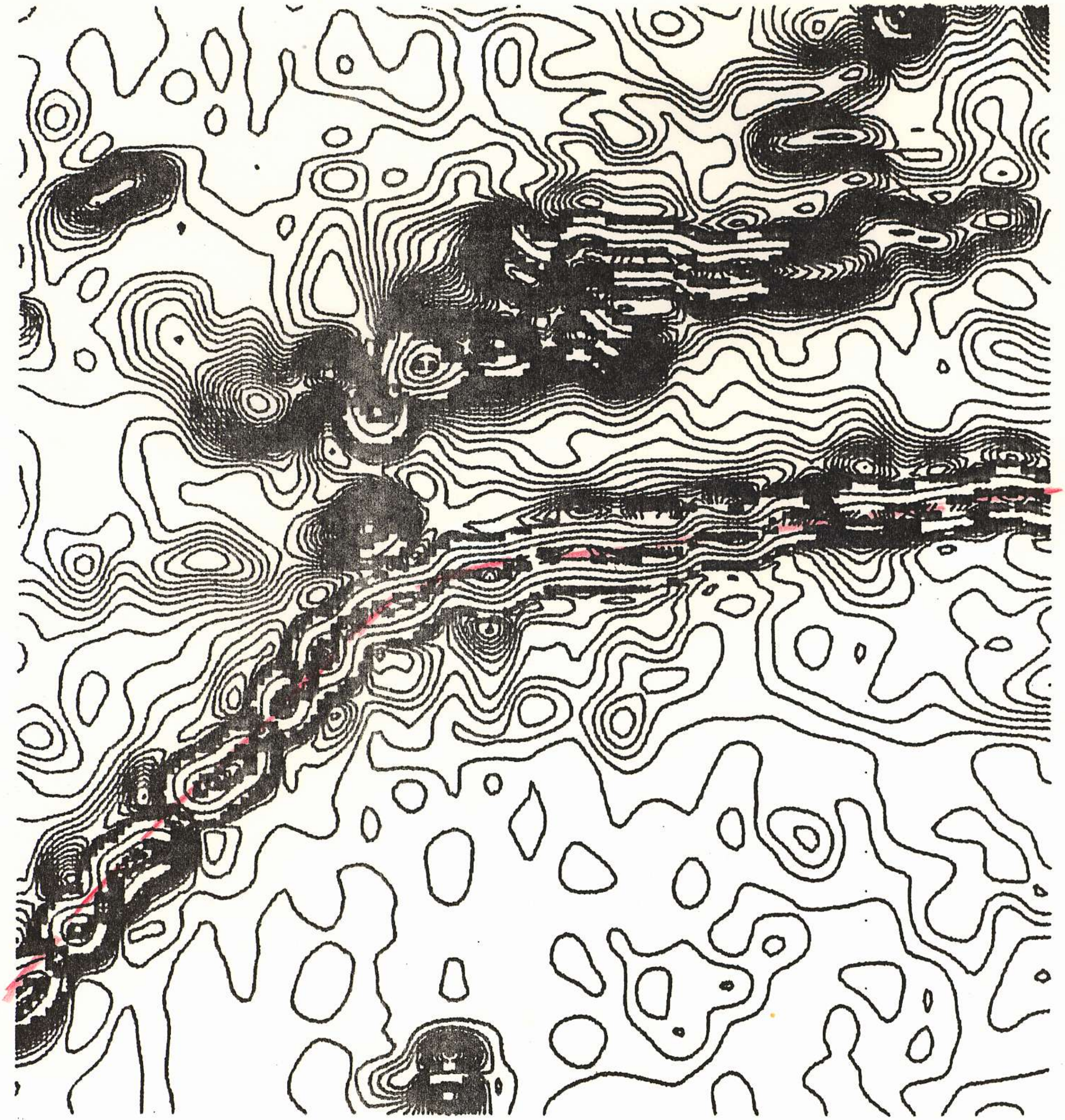


Figure 7: Elliptic Filter (1)

Figure 8: Elliptic Filter (2)

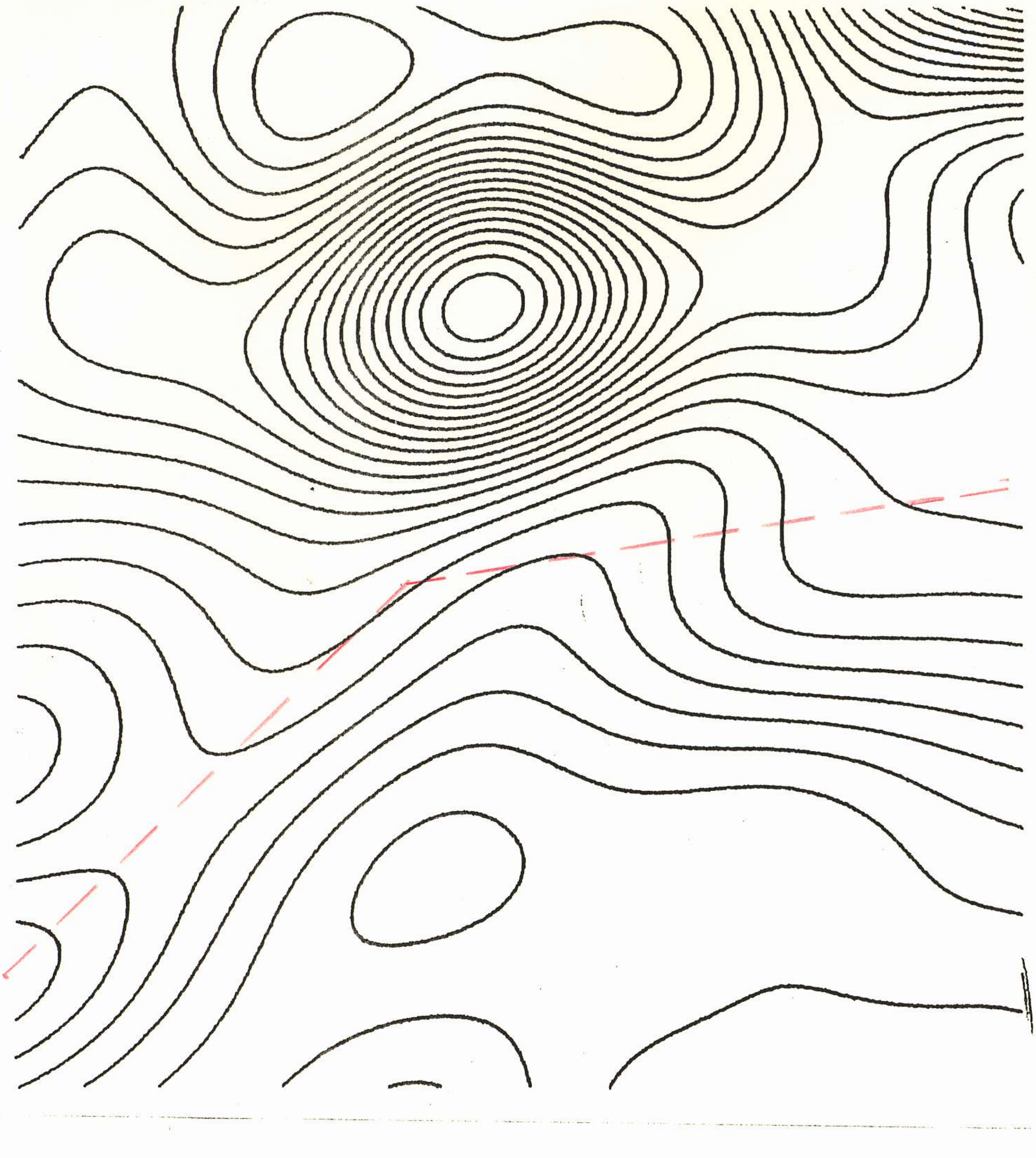


Figure 9: Elliptic Filter (3)

2) At mid frequency, a more gradual attenuation of the near-surface component,
3) At high frequency, a flat white-noise level.

USE CROSSHAIR ON GRAPH OF POWER SPECTRUM TO MARK FOUR POINTS
FROM LEFT TO RIGHT THAT DEFINE (IN PAIRS) :
SLOPE AT LOW FREQUENCY, AND
SLOPE AT MID FREQUENCY.

LOCATE POINT 1

LOCATE POINT 2

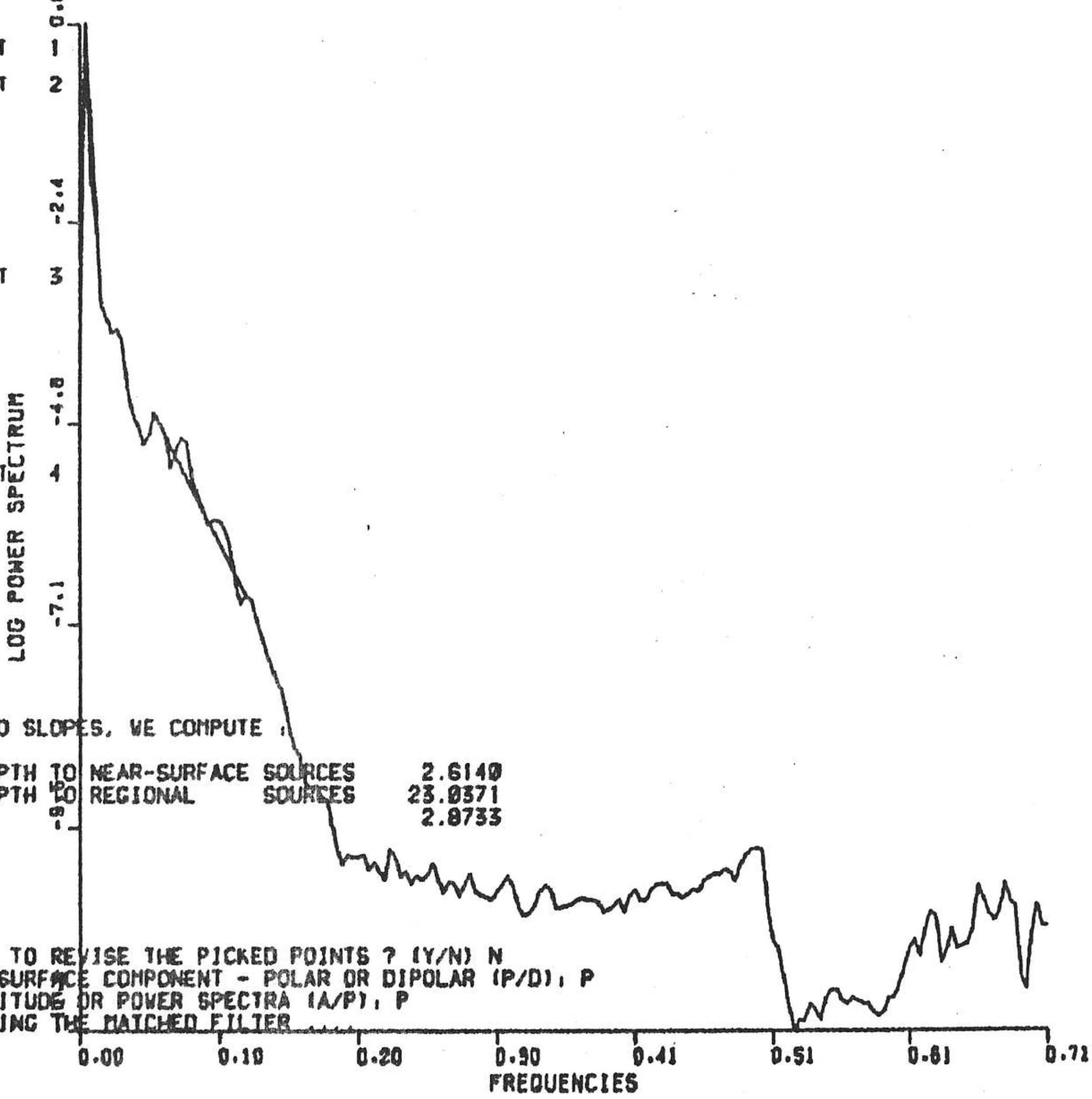
$<0)

LOCATE POINT 3

&!,4

LOCATE POINT 4

';)&



FROM THE TWO SLOPES, WE COMPUTE :

APPARENT DEPTH TO NEAR-SURFACE SOURCES 2.6140
APPARENT DEPTH TO REGIONAL SOURCES 23.0371
POWER RATIO 2.0733

DO YOU WISH TO REVISE THE PICKED POINTS ? (Y/N) N
ENTER NEAR-SURFACE COMPONENT - POLAR OR DIPOLAR (P/D): P
ENTER AMPLITUDE OR POWER SPECTRA (A/P): P
I AM APPLYING THE MATCHED FILTER .....

Figure 10: Downward Continuation (1 grid cell) and power spectrum

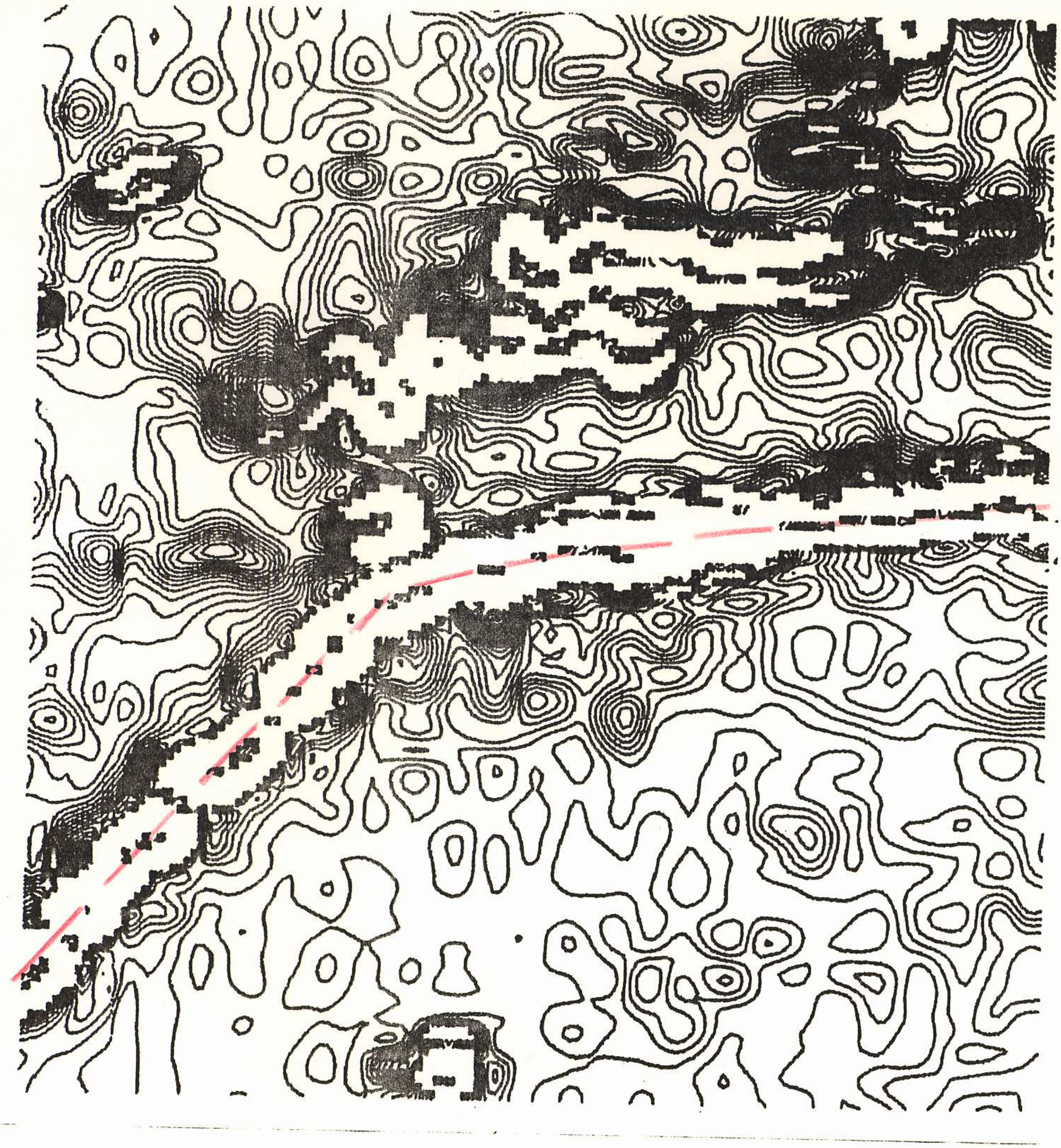


Figure 11: Downward Continuation (1 grid cell) and power spectrum

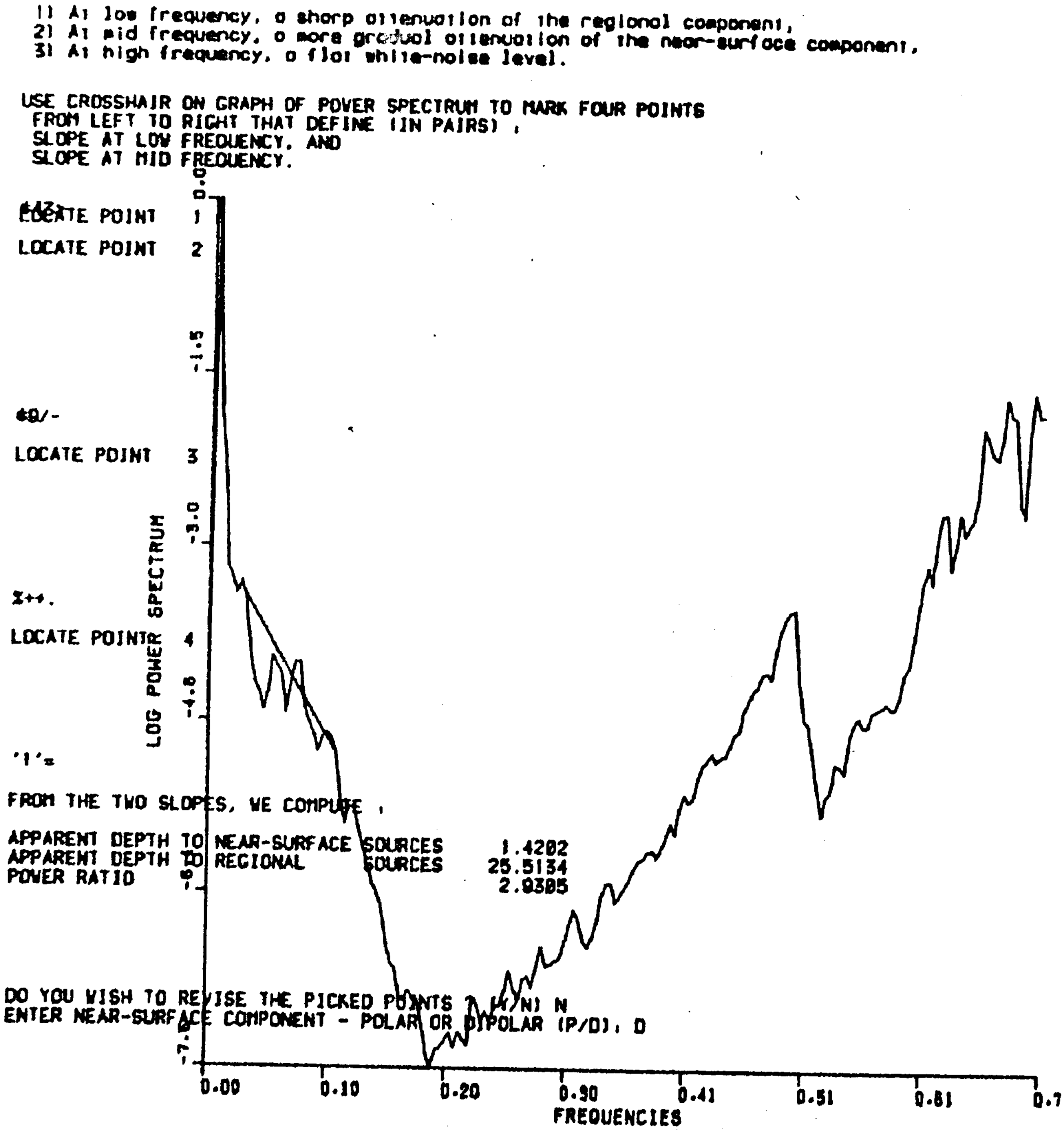


Figure 12: Downward Continuation (2 grid cells) and power spectrum

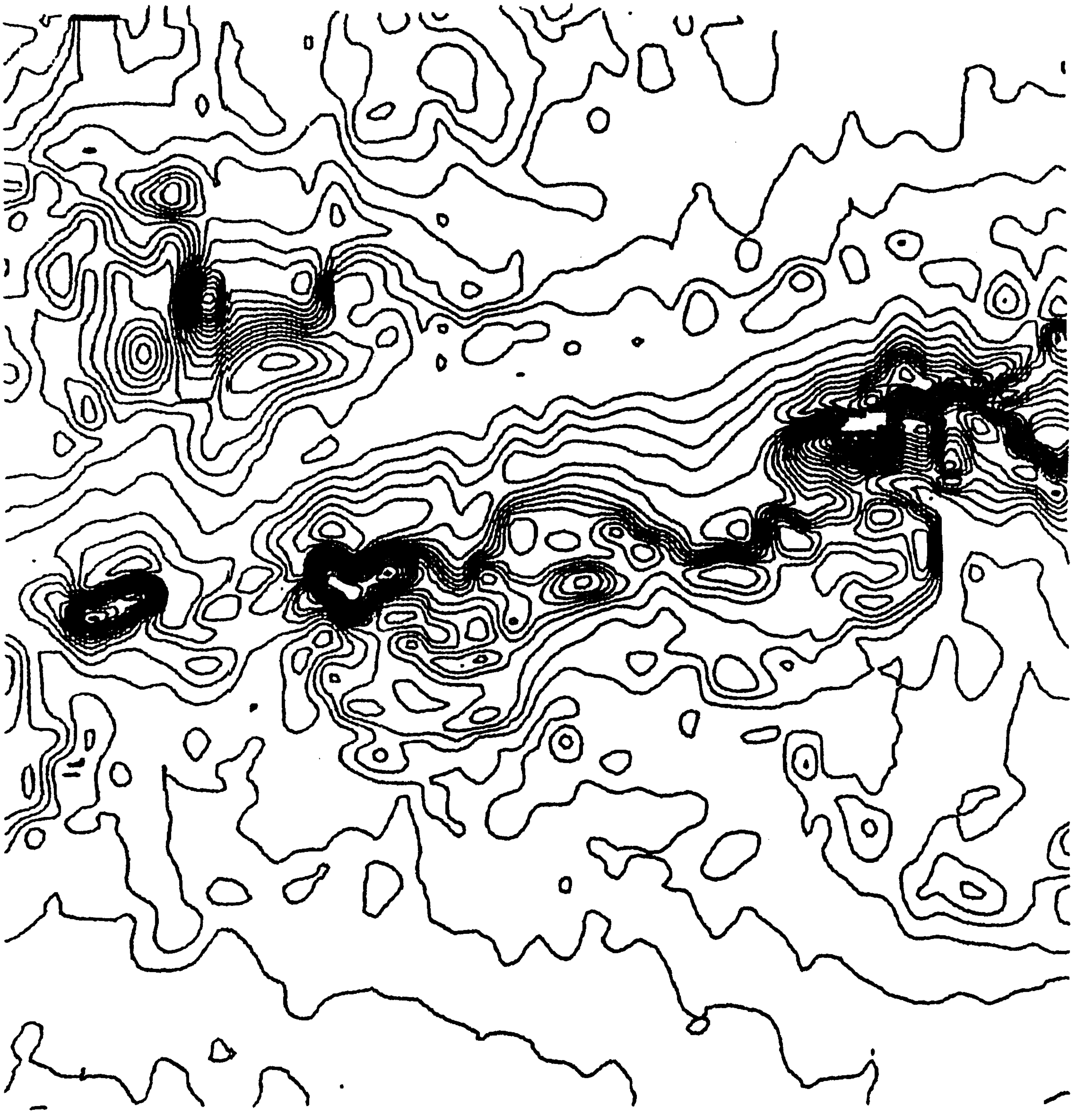


Figure 13: Total Field Magnetic Contours (Contour interval: 100 nT)

1) At low frequency, a sharp attenuation of the regional component,
2) At mid frequency, a more gradual attenuation of the near-surface component,
3) At high frequency, a flat white-noise level.

USE CROSSHAIR ON GRAPH OF POWER SPECTRUM TO MARK FOUR POINTS
FROM LEFT TO RIGHT THAT DEFINE (IN PAIRS) :
SLOPE AT LOW FREQUENCY, AND
SLOPE AT MID FREQUENCY.

LOCATE POINT 1

LOCATE POINT 2

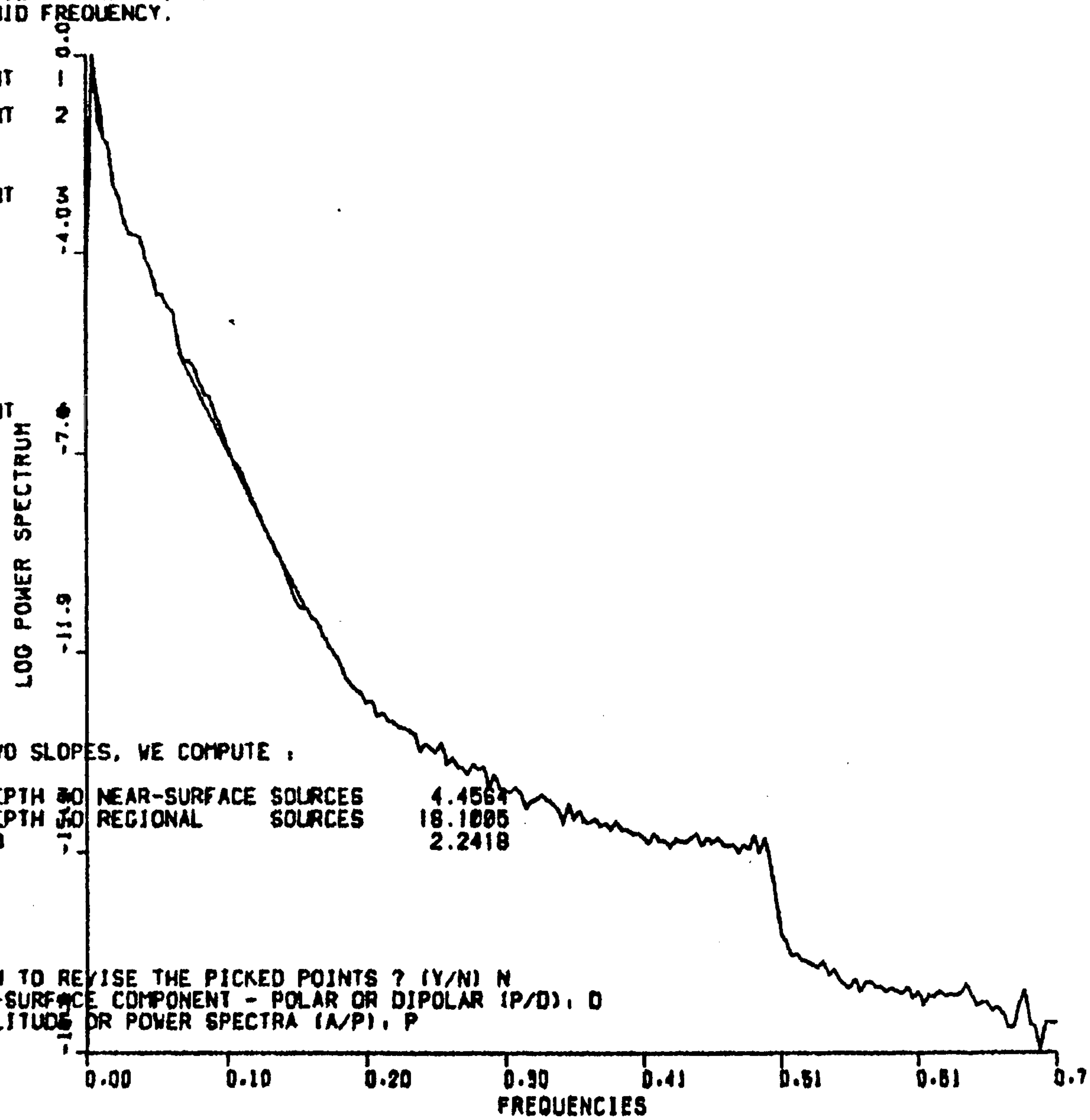
&<2-

LOCATE POINT 3

&,.*

LOCATE POINT 4

(<1/



FROM THE TWO SLOPES, WE COMPUTE :

APPARENT DEPTH TO NEAR-SURFACE SOURCES 4.4564
APPARENT DEPTH TO REGIONAL SOURCES 18.1805
POWER RATIO 2.2418

DO YOU WISH TO REVISE THE PICKED POINTS ? (Y/N) N
ENTER NEAR-SURFACE COMPONENT - POLAR OR DIPOLAR (P/D): D
ENTER AMPLITUDE OR POWER SPECTRA (A/P): P

Figure 14: Power Spectrum (1)

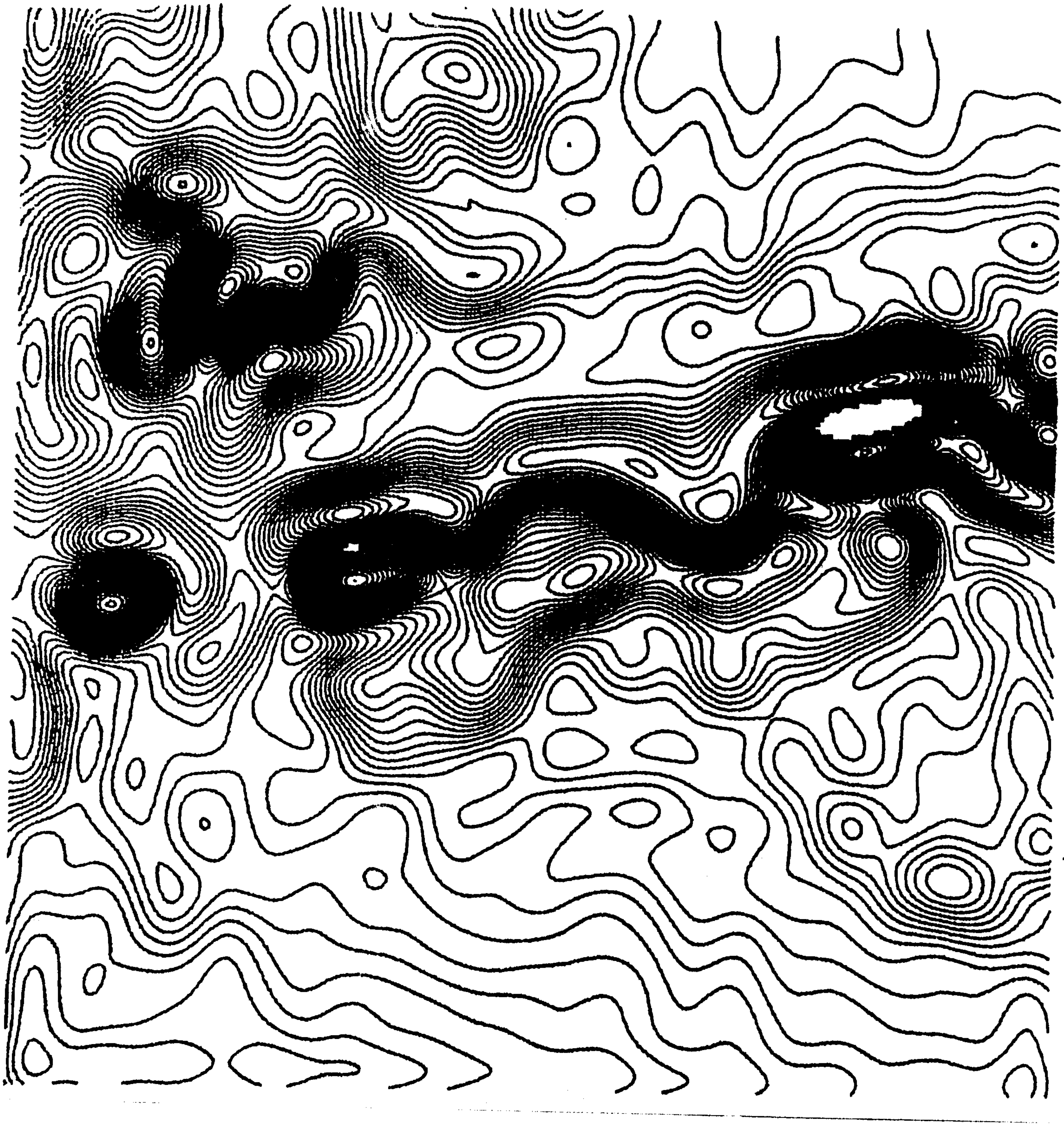


Figure 15: Regional Map (1)

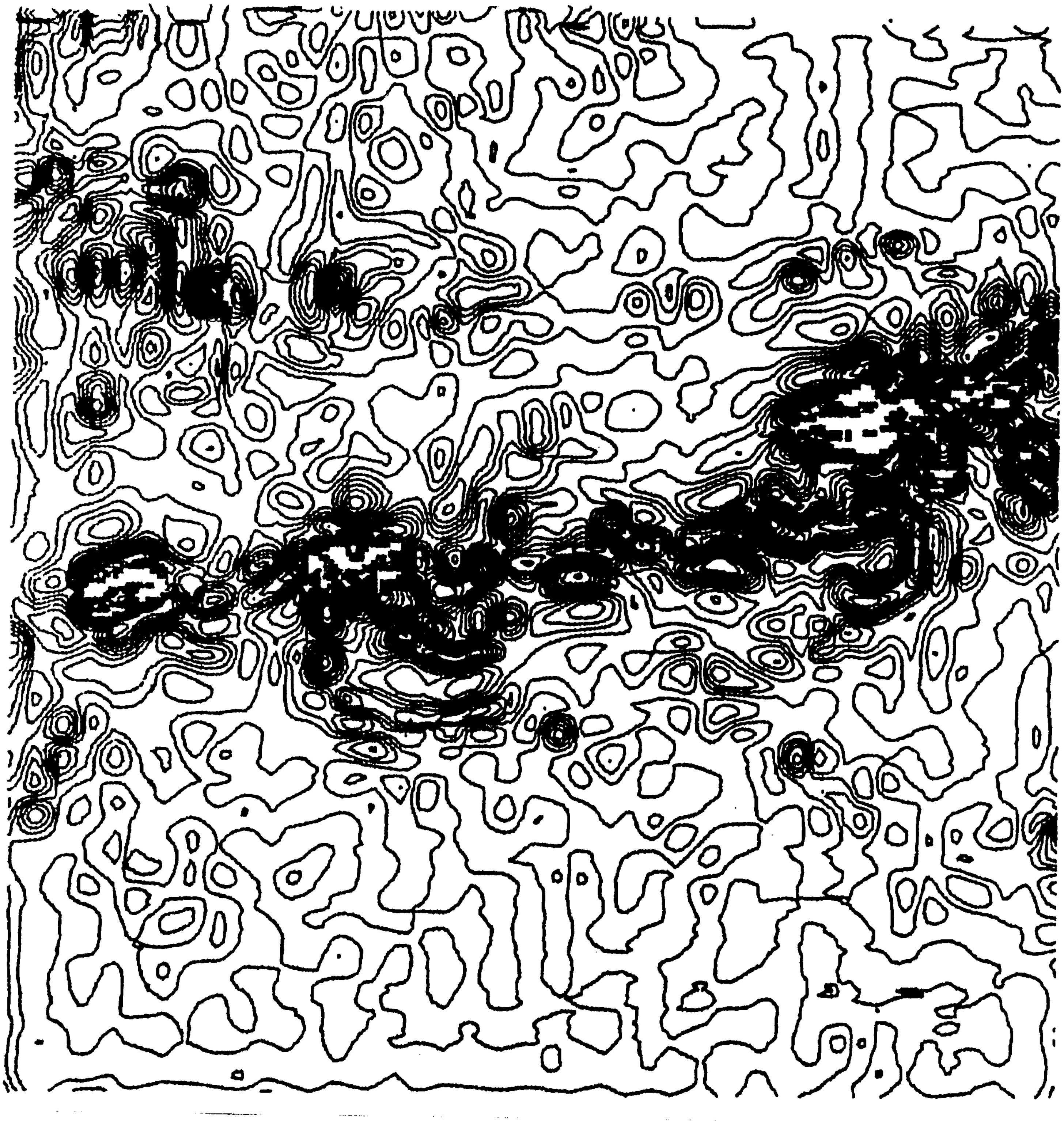


Figure 16: Residual Map (1)

2) At mid frequency, a more gradual attenuation of the near-surface component,
3) At high frequency, a flat white-noise level.

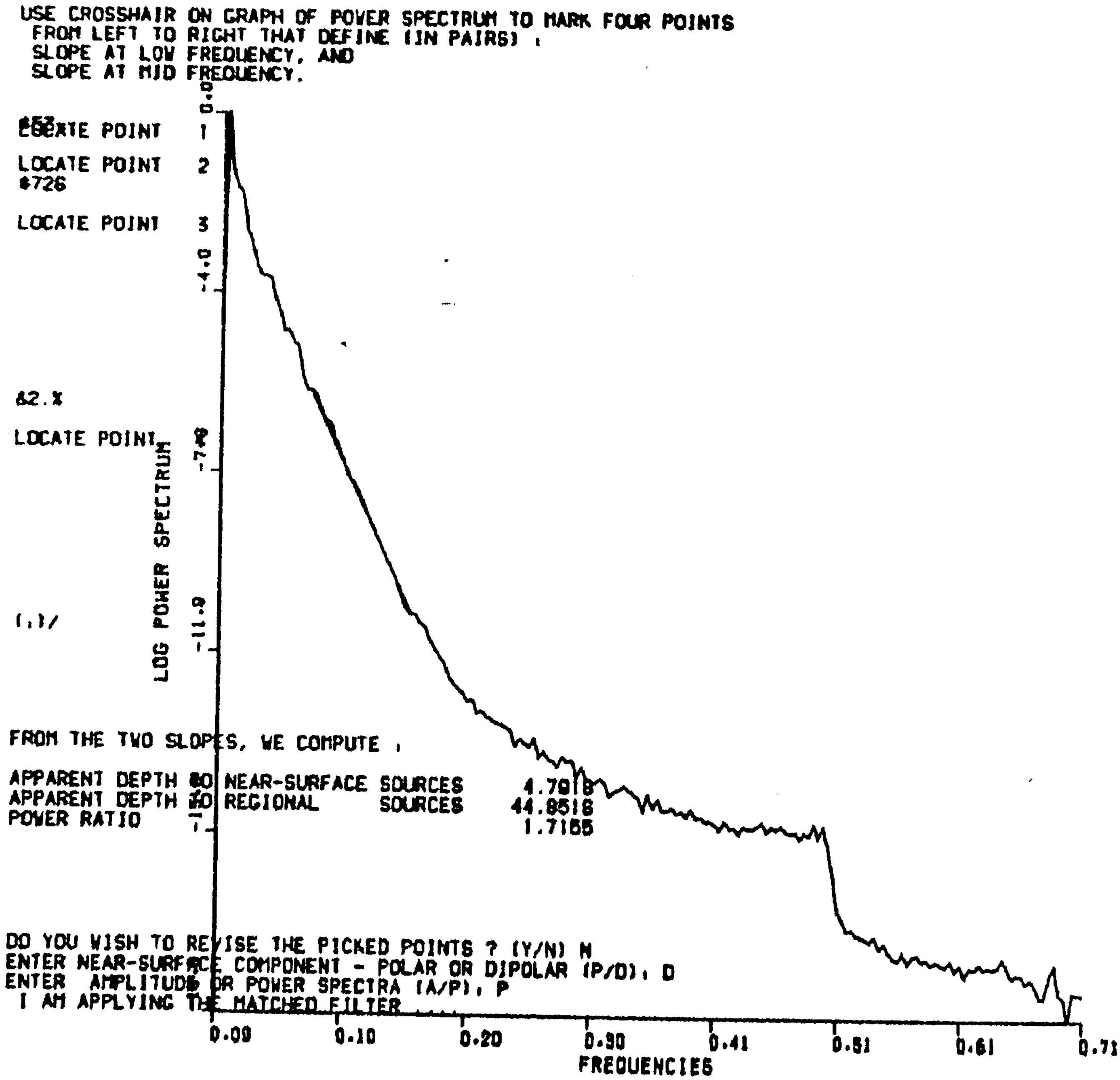


Figure 17: Power Spectrum (2)

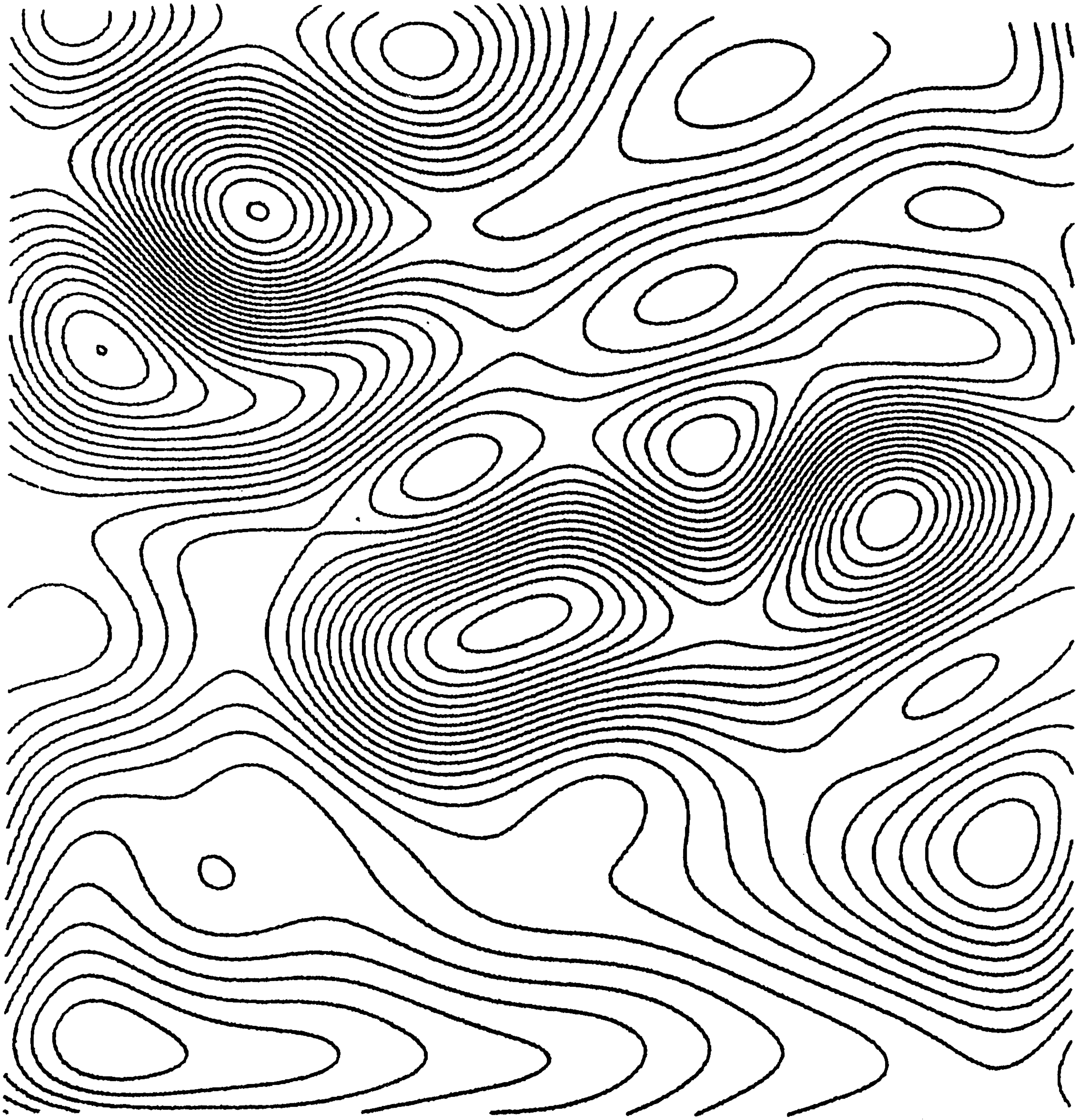
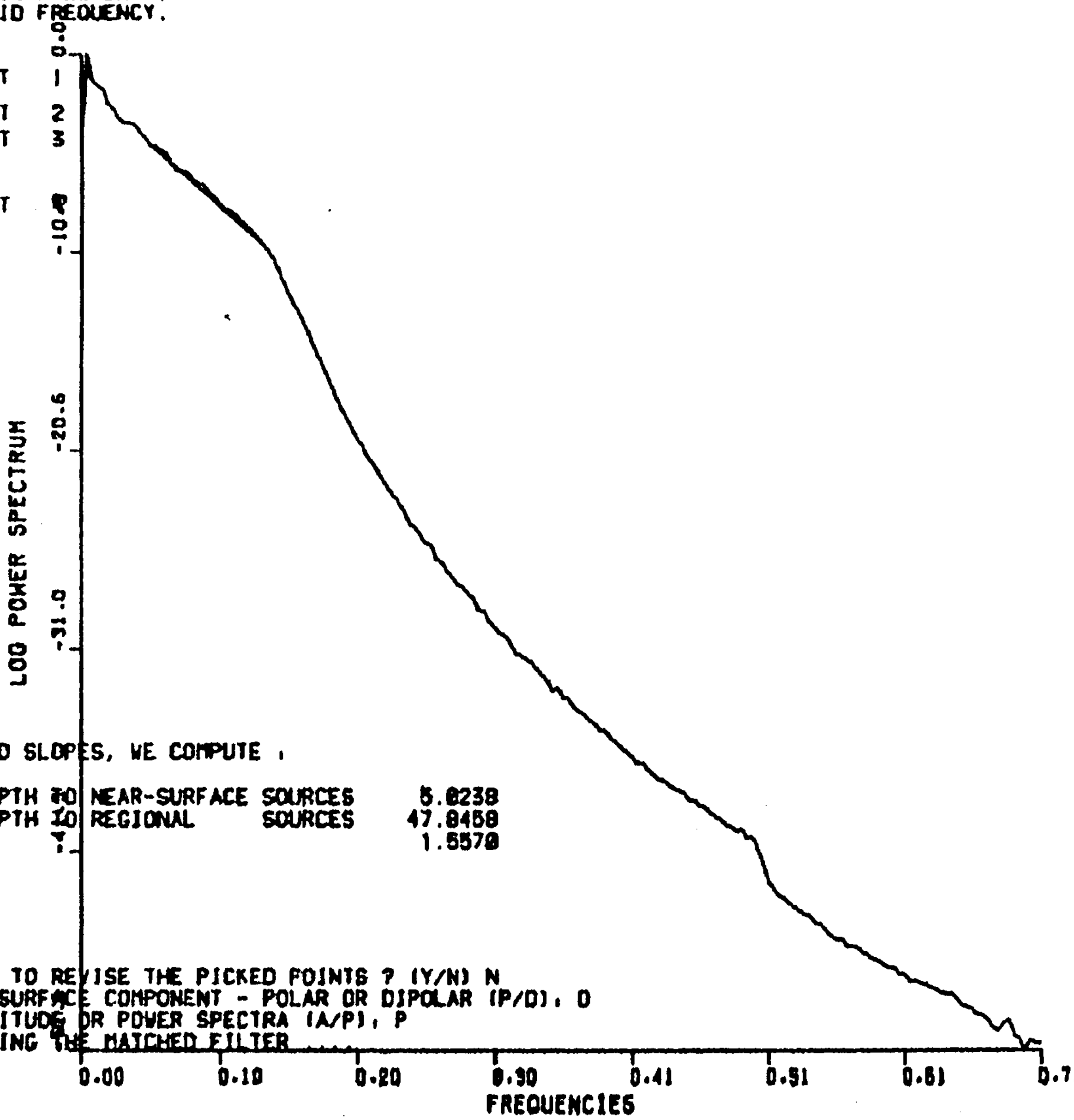


Figure 18: Regional Map (2)

1) At low frequency, a sharp attenuation of the regional component,
2) At mid frequency, a more gradual attenuation of the near-surface component,
3) At high frequency, a flat white-noise level.

USE CROSSHAIR ON GRAPH OF POWER SPECTRUM TO MARK FOUR POINTS
FROM LEFT TO RIGHT THAT DEFINE (IN PAIRS) :
SLOPE AT LOW FREQUENCY, AND
SLOPE AT MID FREQUENCY.

LOCATE POINT 1
LOCATE POINT 2
LOCATE POINT 3
X?24
LOCATE POINT 4



FROM THE TWO SLOPES, WE COMPUTE :

APPARENT DEPTH TO NEAR-SURFACE SOURCES 5.0238
APPARENT DEPTH TO REGIONAL SOURCES 47.8458
POWER RATIO 1.5570

DO YOU WISH TO REVISE THE PICKED POINTS ? (Y/N) N
ENTER NEAR-SURFACE COMPONENT - POLAR OR DIPOLAR (P/D): D
ENTER AMPLITUDE OR POWER SPECTRA (A/P): P
I AM APPLYING THE MATCHED FILTER ....

Figure 19: Elliptic Filter and Power Spectrum

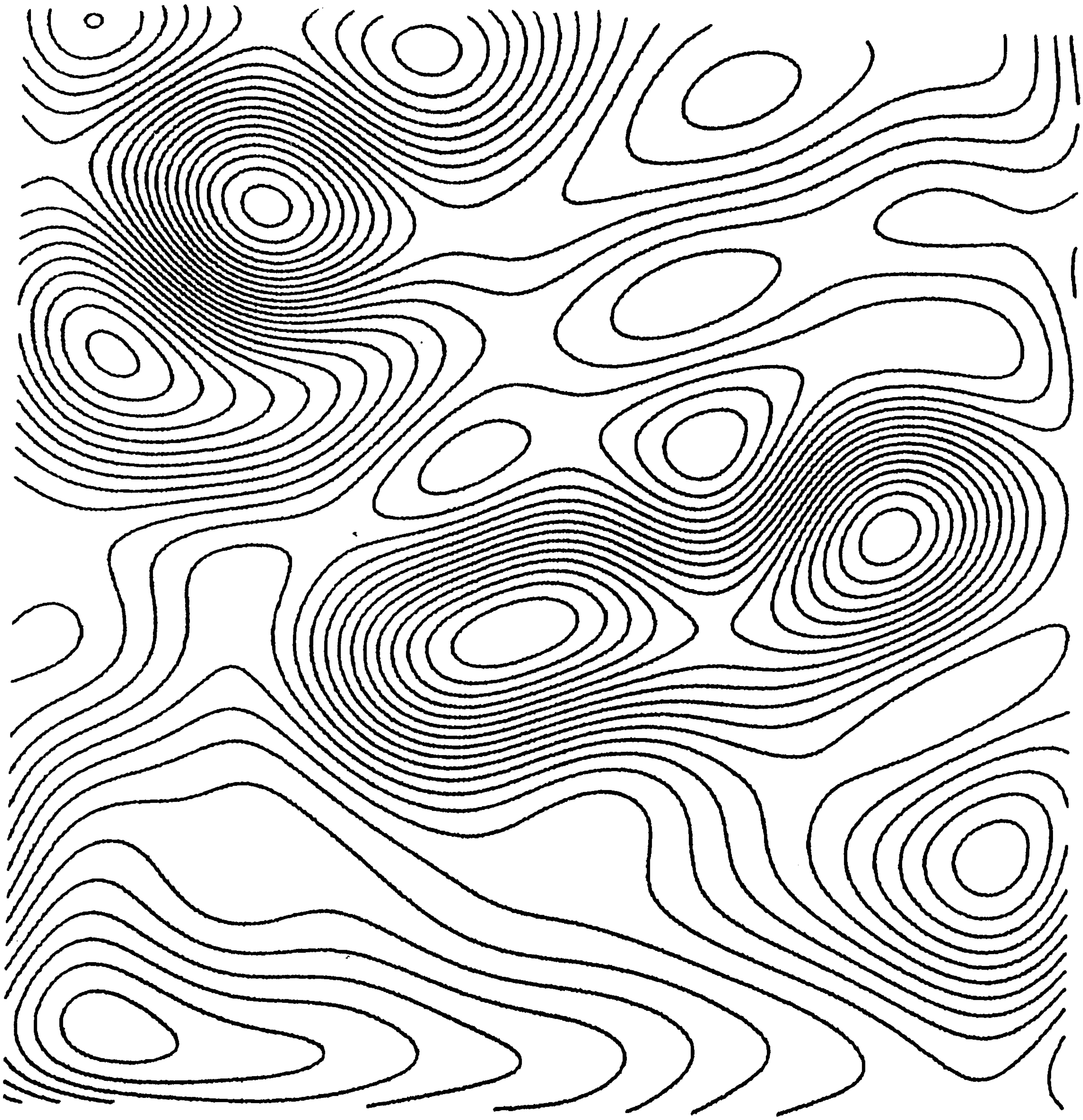


Figure 20: Regional Map

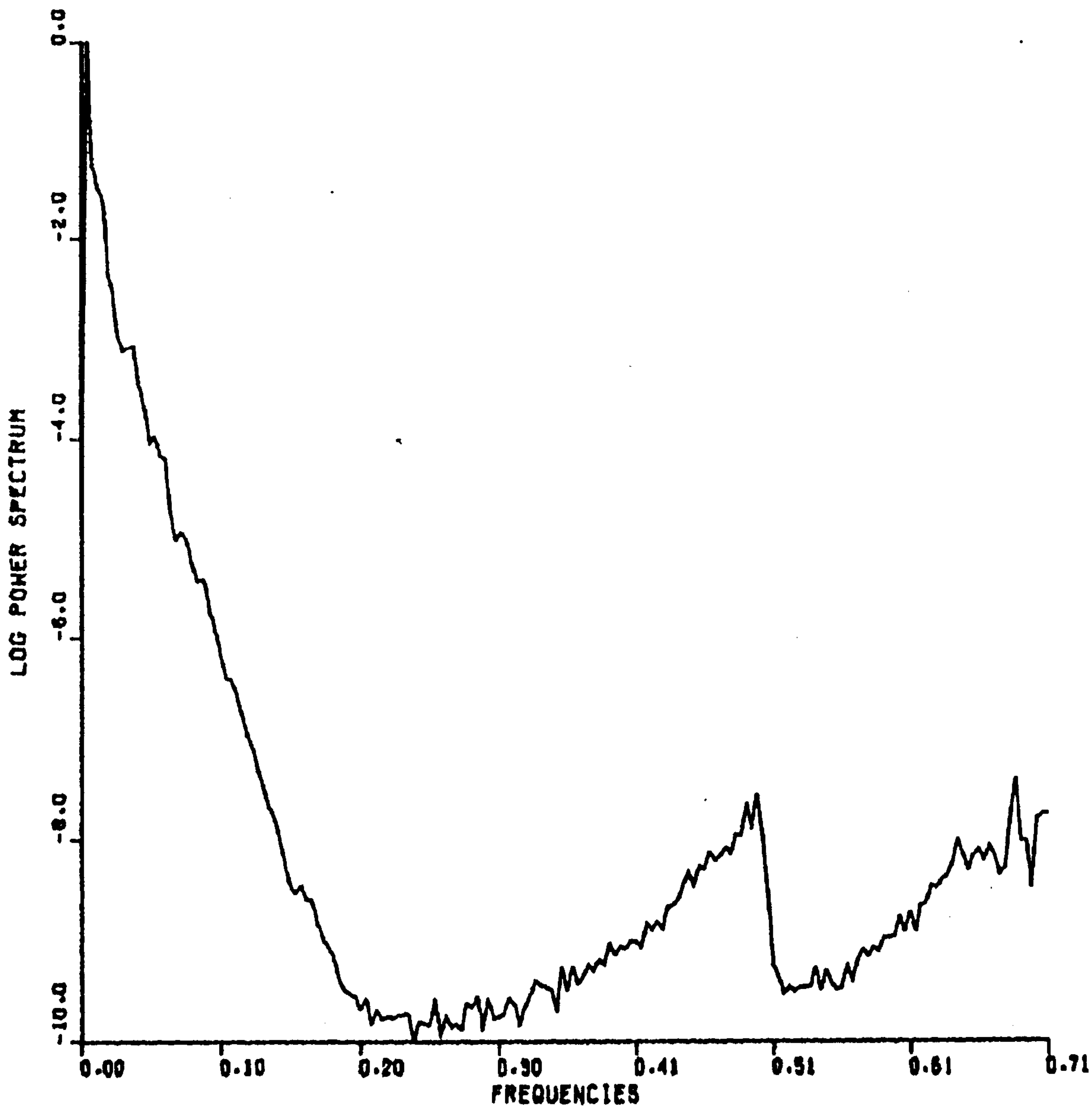


Figure 21: Downward Continuation (1.3 grid cells) and Power Spectrum

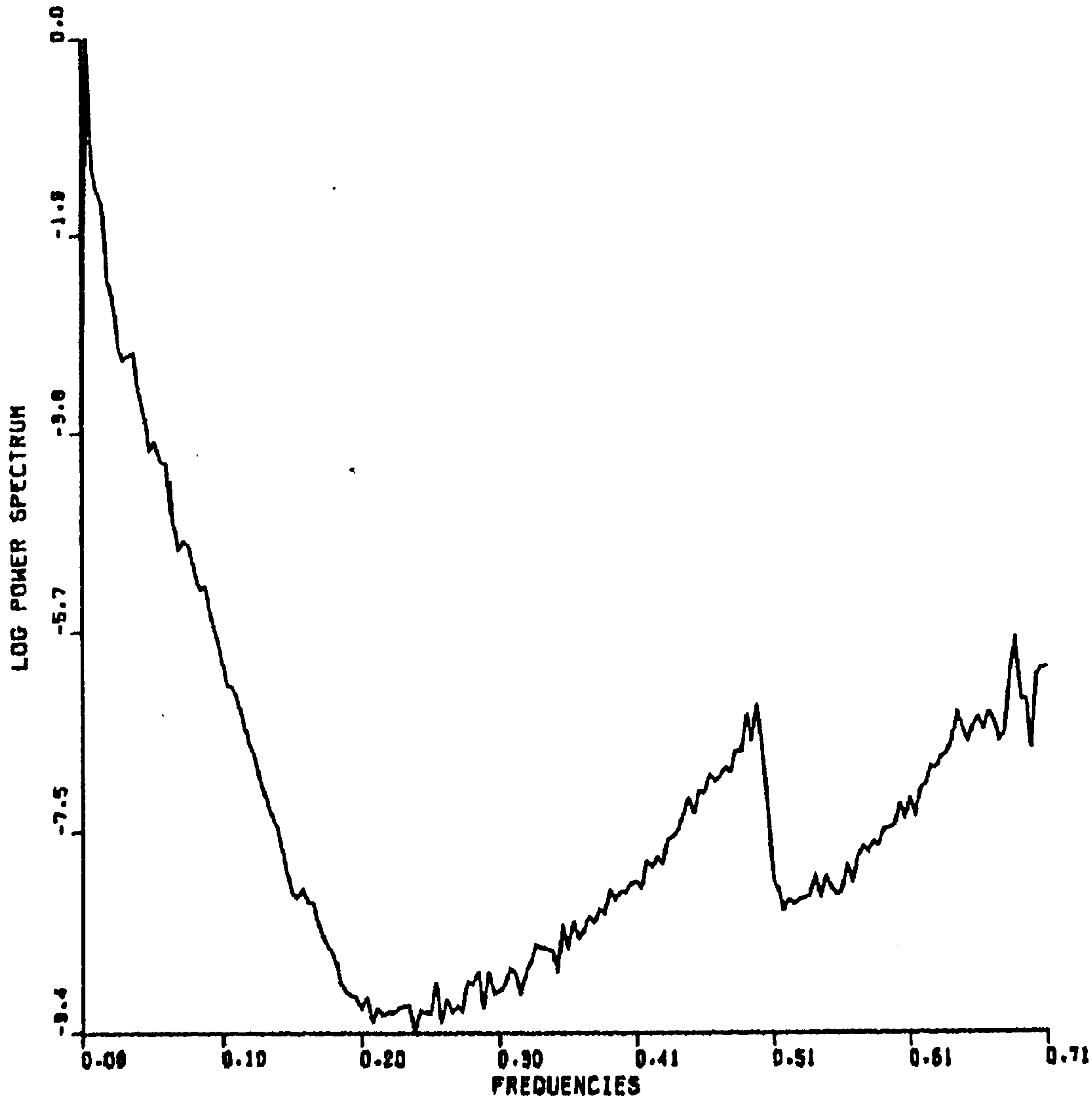


Figure 22: Downward Continuation (1.5 grid cells) and Power Spectrum

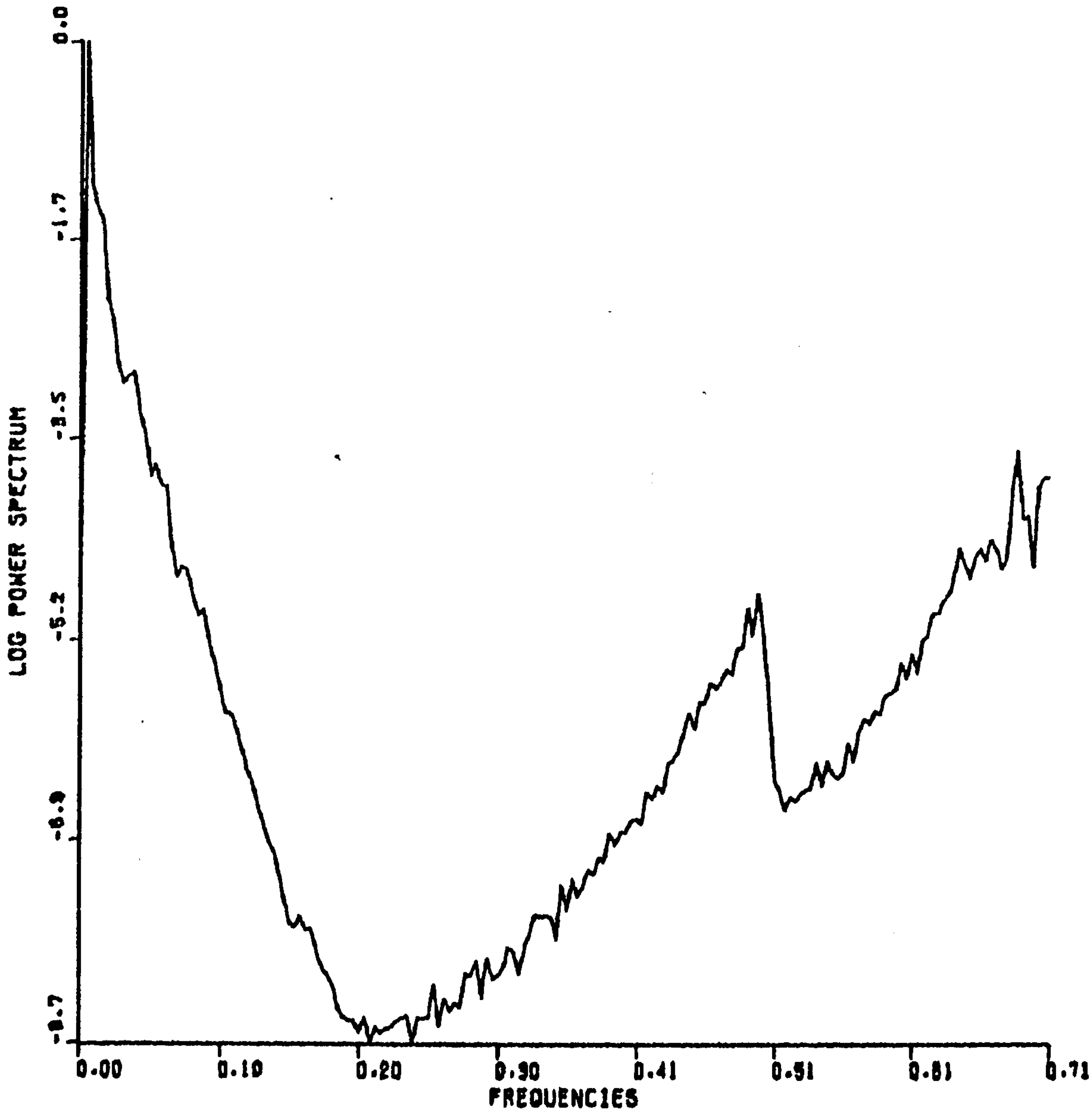


Figure 23: Downward Continuation (1.75 grid cells) and Power Spectrum

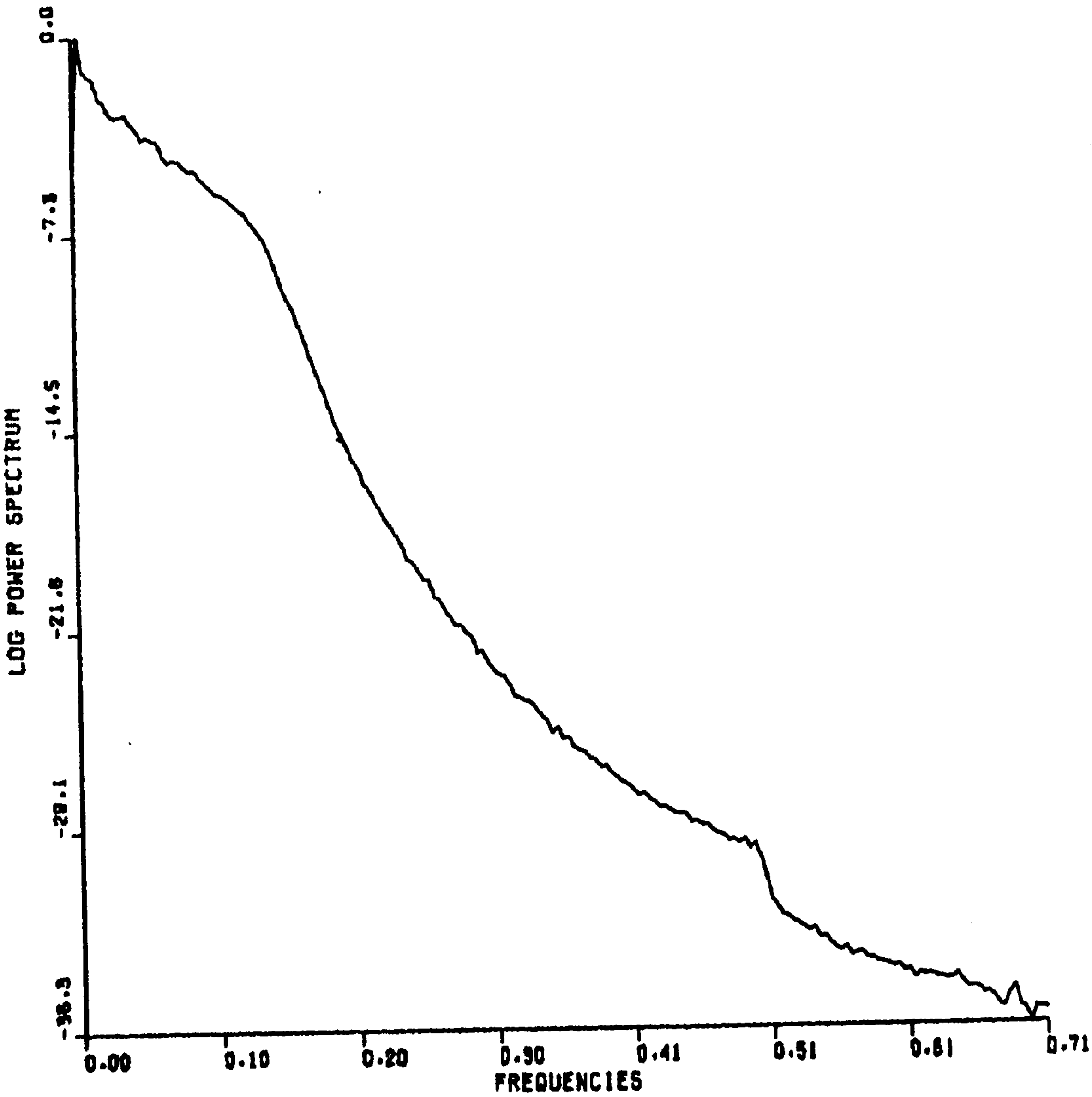


Figure 24: Elliptic Filter, Downward Continuation (1.75 grid cells) and Power Spectrum

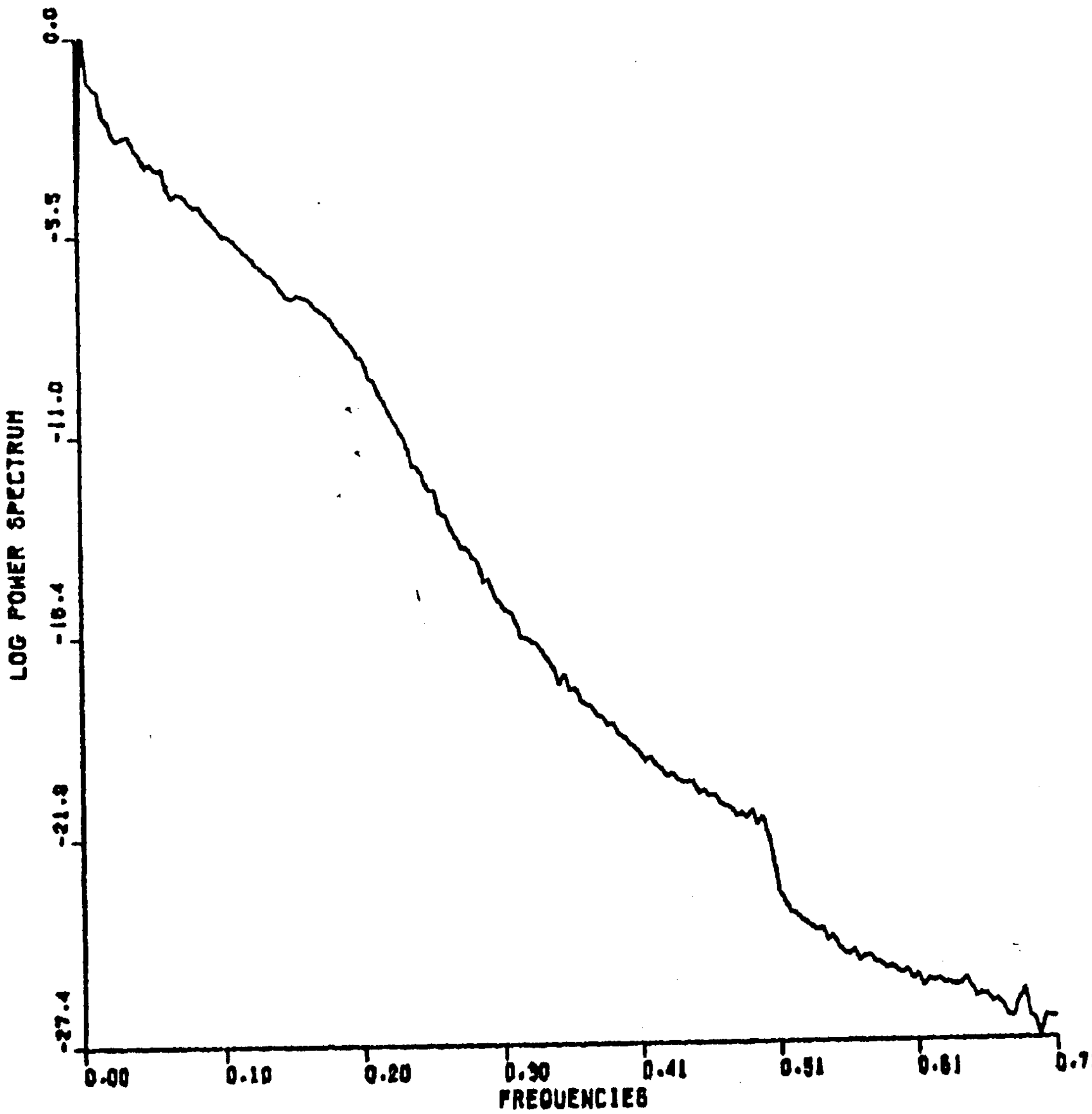


Figure 25: Elliptic Filter, Downward Continuation (2 grid cells) and Power Spectrum

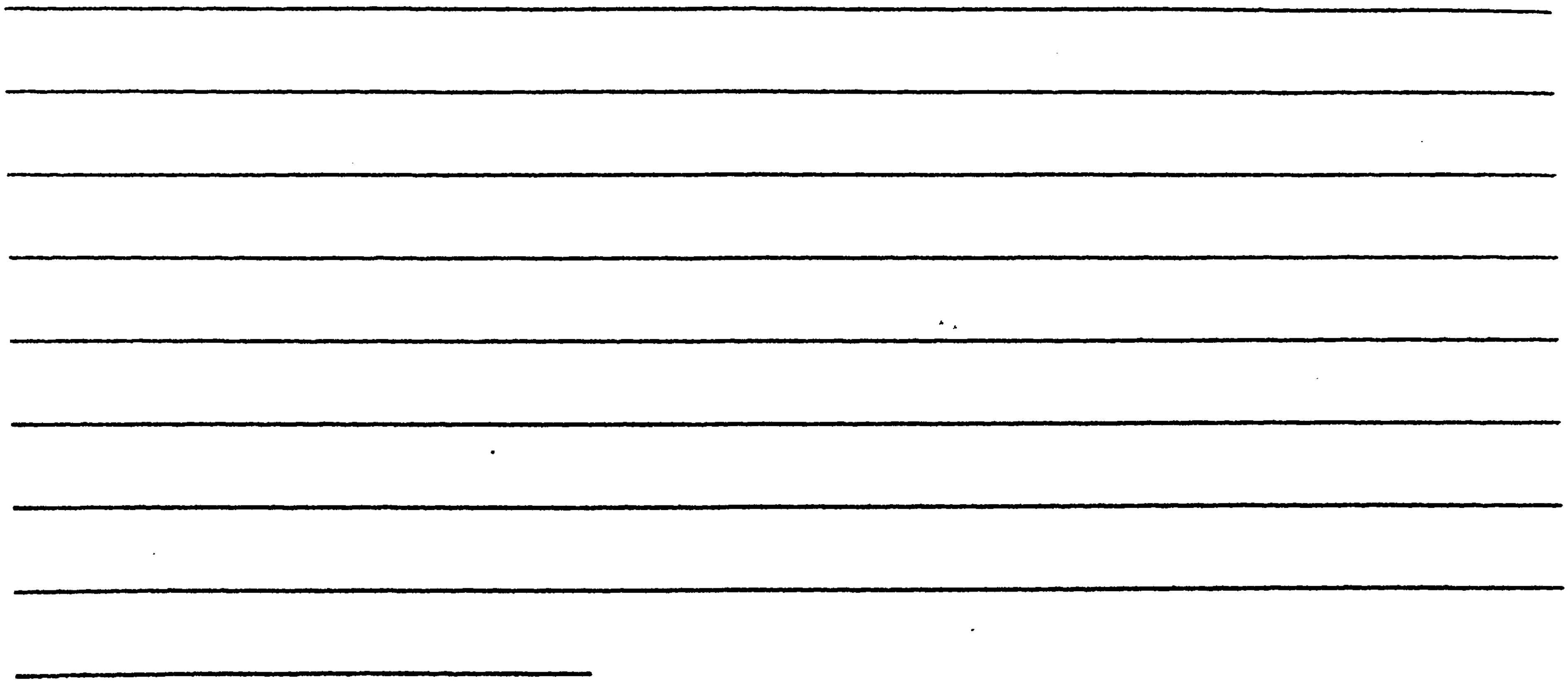


Figure 26: First Order Regression (Contour interval: 20 nT)

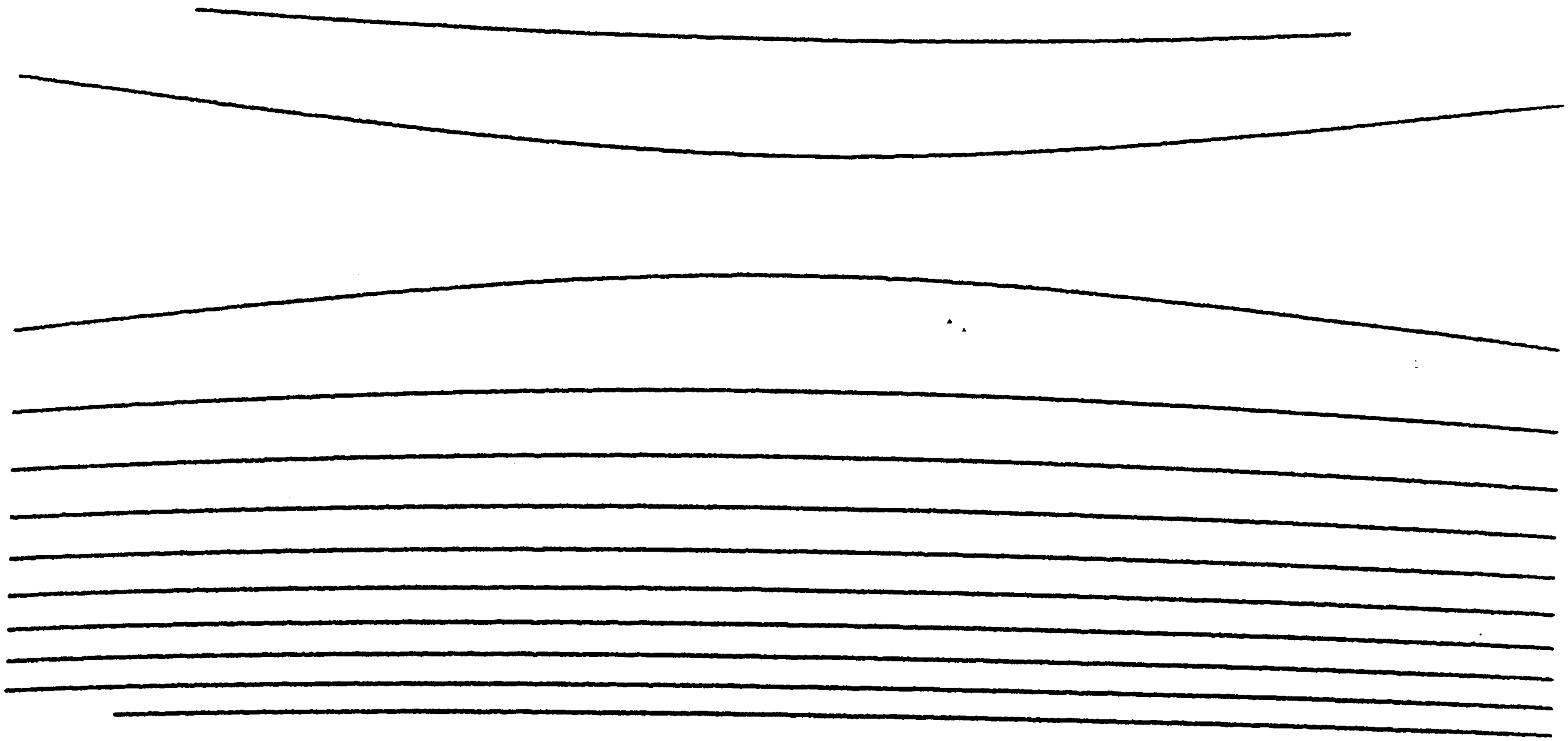


Figure 27: Second Order Regression (Contour interval: 20 nT)

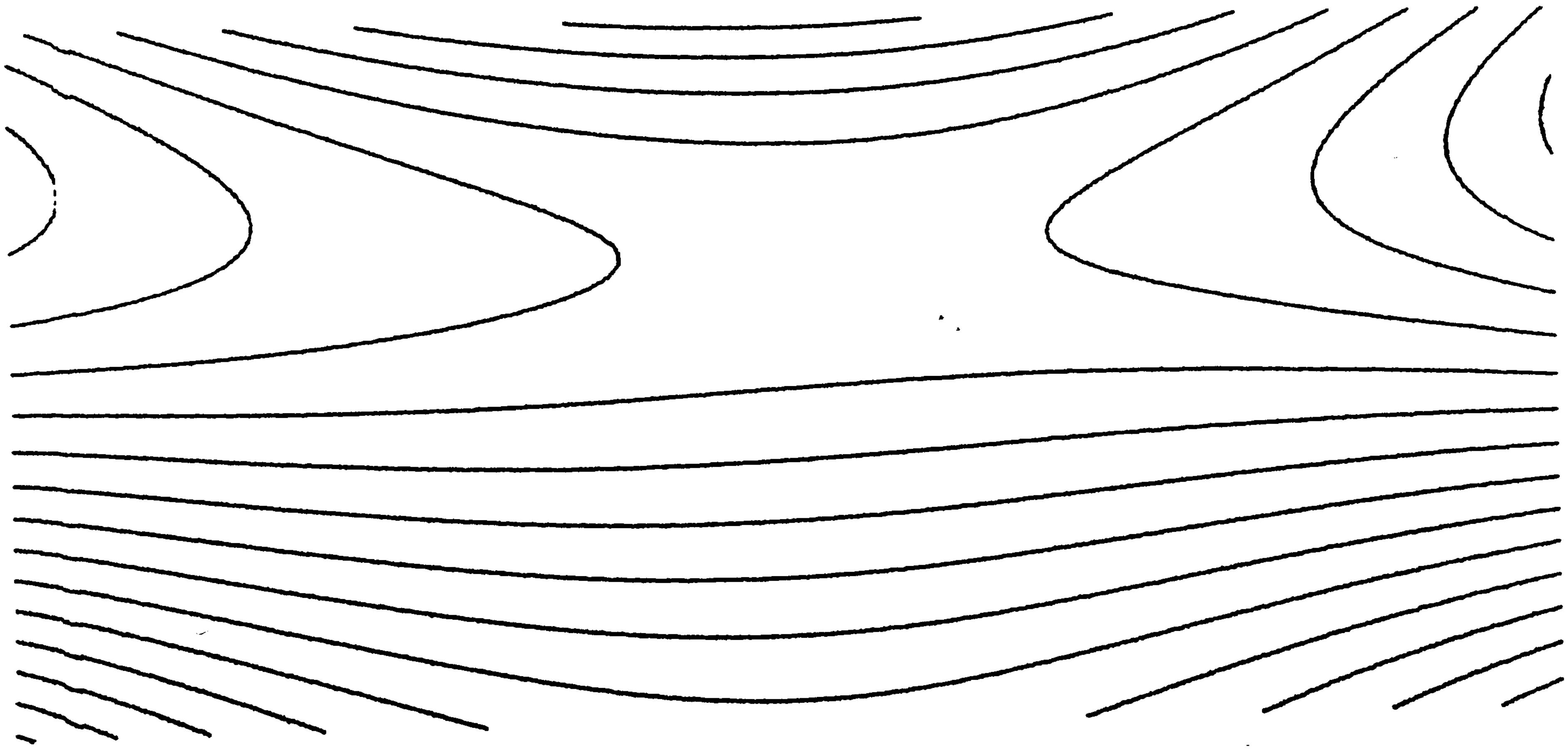


Figure 28: Third Order Regression (Contour interval: 20 nT)

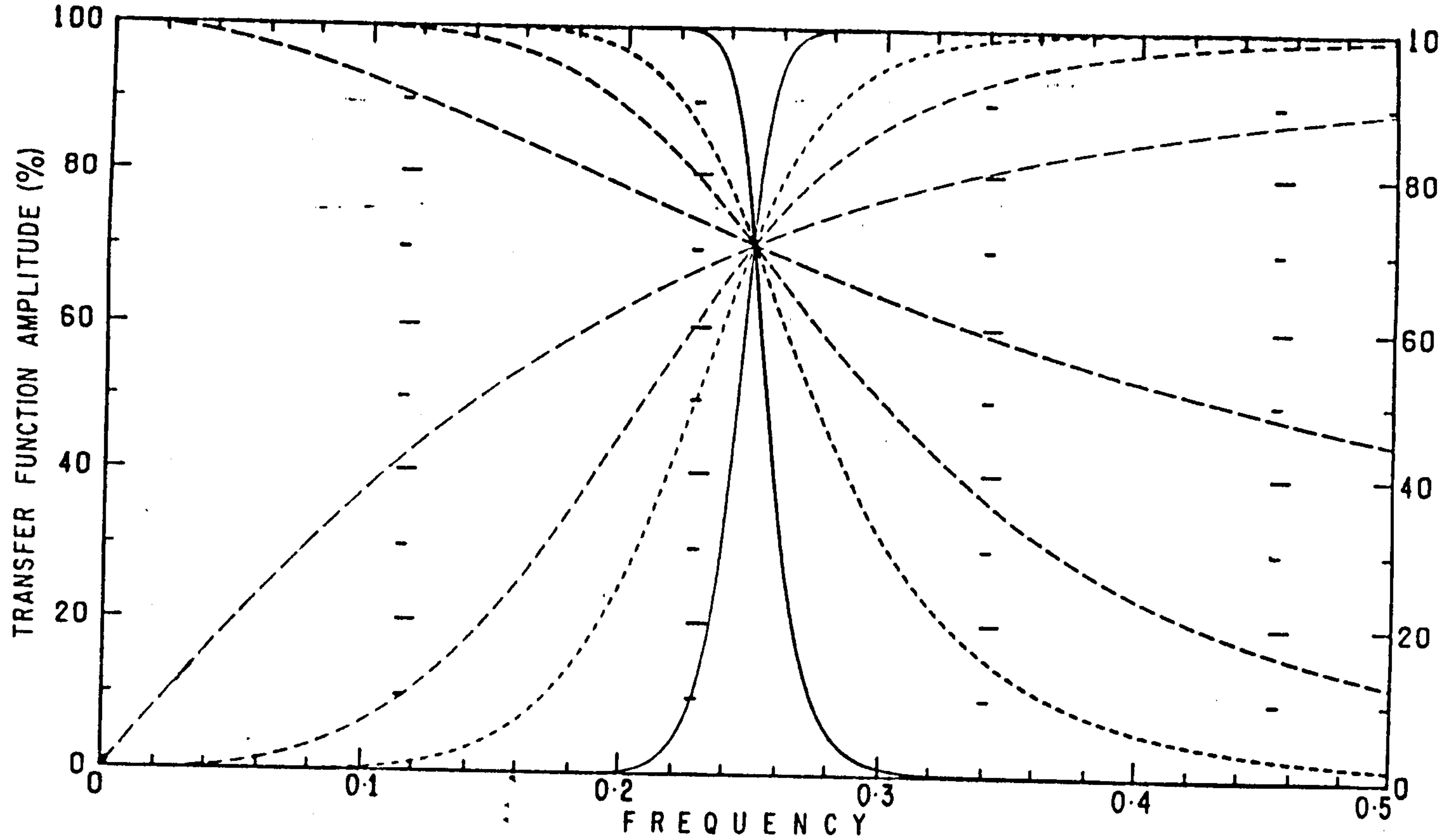


Fig. : HIGH PASS AND LOW PASS FILTER AT FREQUENCY CUTOFF 0·25 AT FOUR ATTENUATION VALUES.

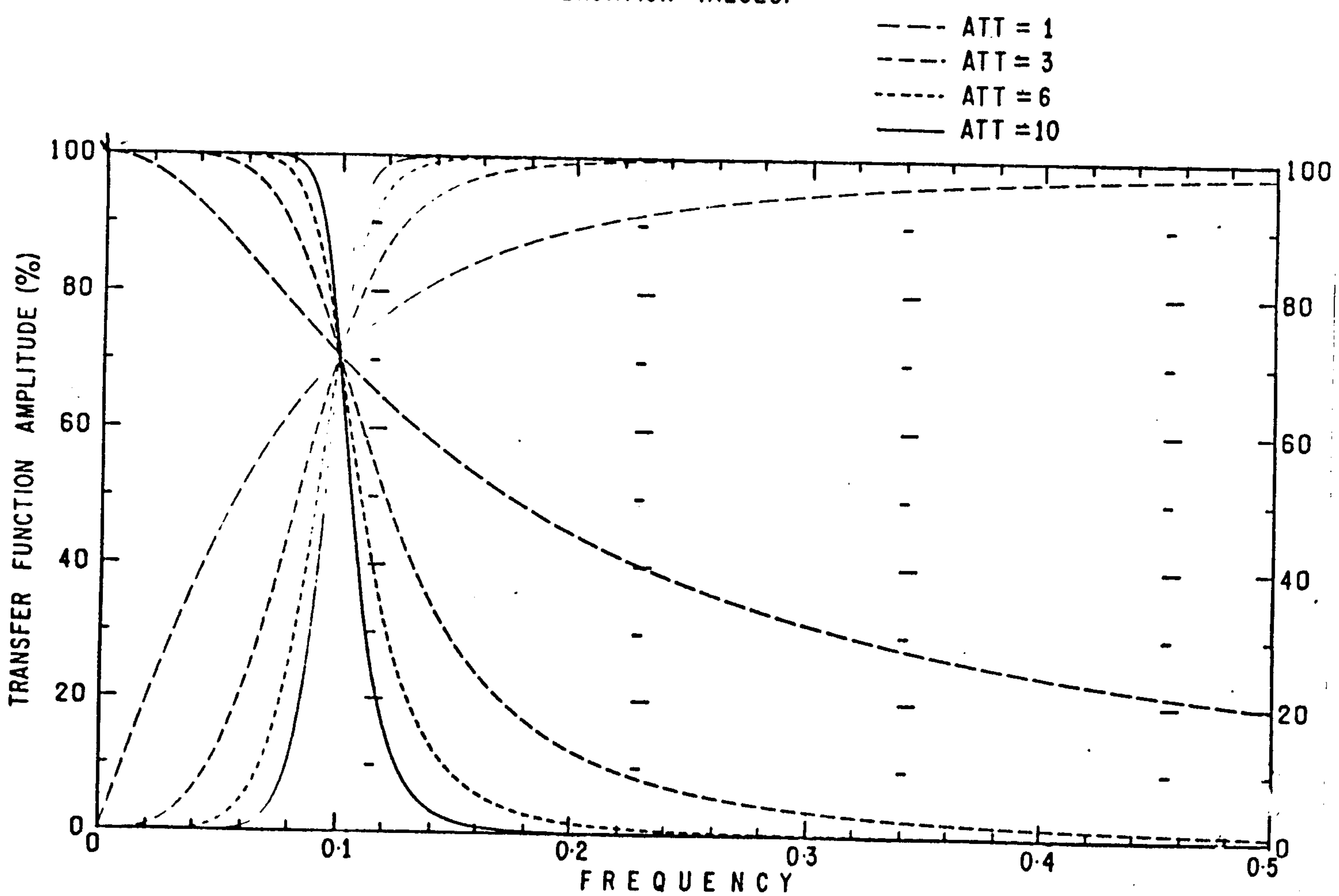


Fig. : HIGH PASS AND LOW PASS FILTER AT FREQUENCY CUTOFF 0·10 AT FOUR ATTENUATION VALUES.

Figure 29: Attenuation Effect on Filter Characteristics