LD 1470

COMPAGNIA PETROLIFERA ITALIANA

TEST REPORT

MONTESILVANO CONCESSION

APRIL 1977

COMPAGNIE GENERALE DE GEOPHYSIQUE
6, Rue Galvani - 91301 - MASSY - FRANCE

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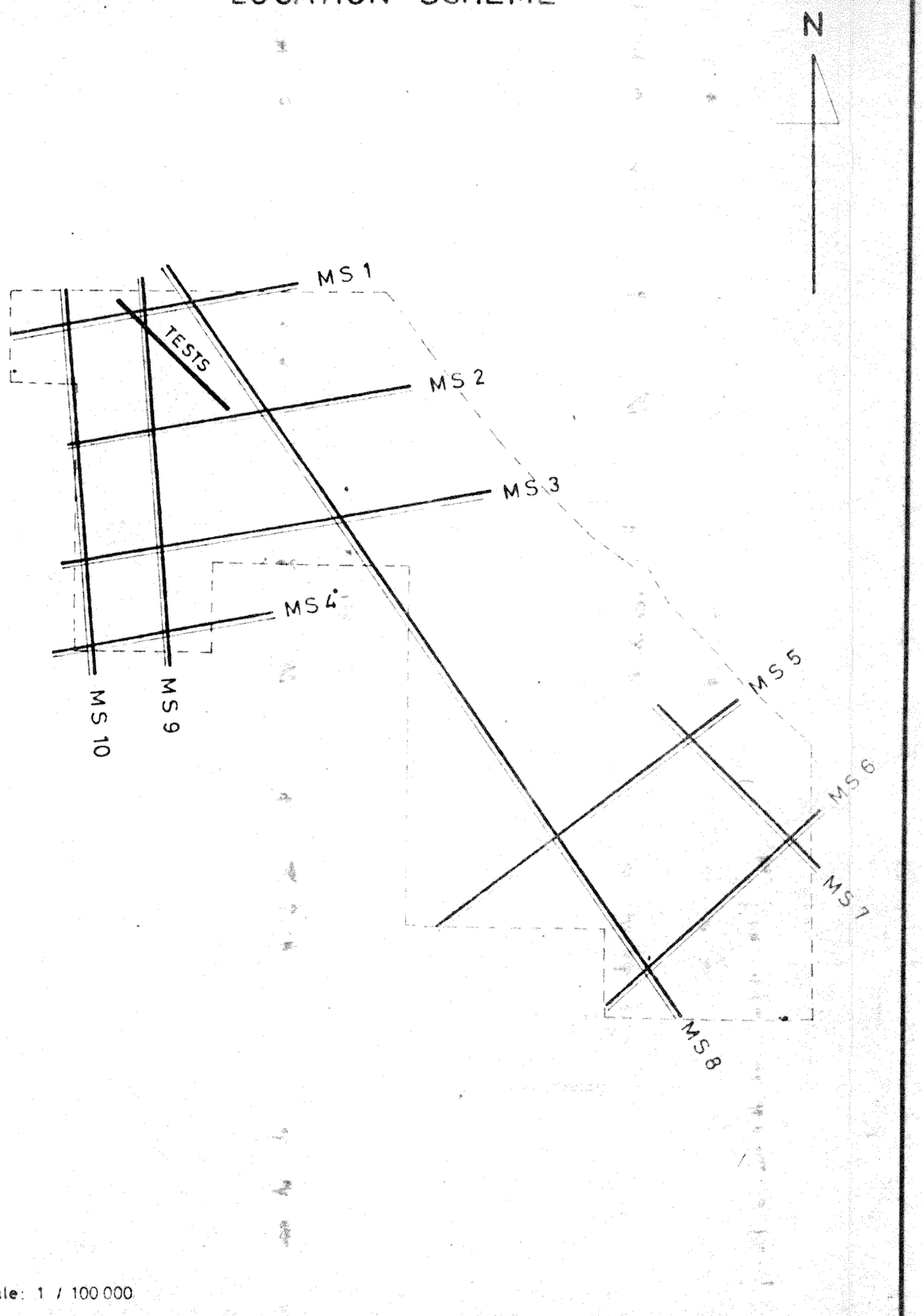
LOCATION SCHEME



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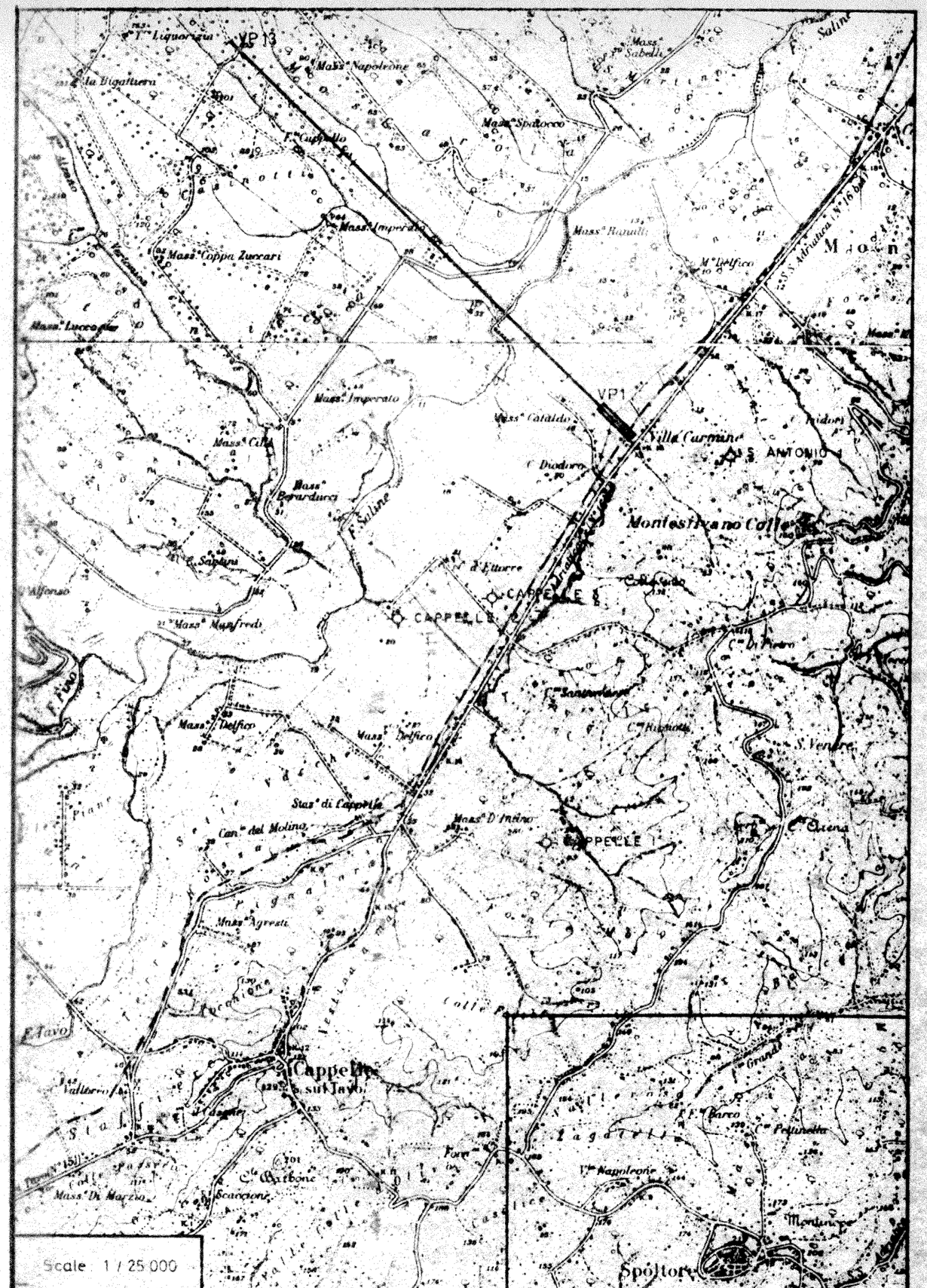
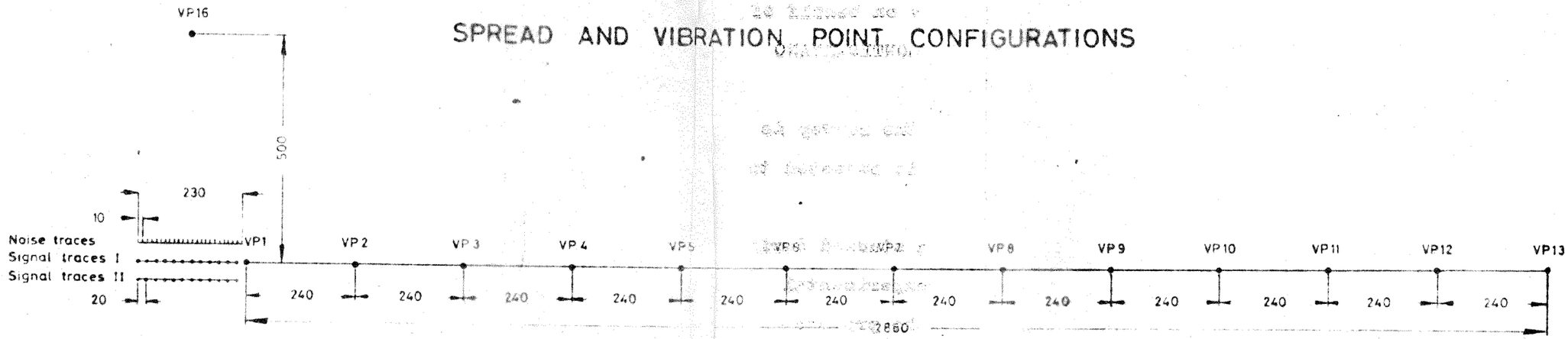


Fig. 2

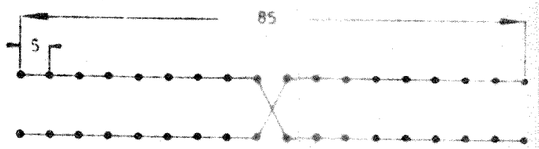
VIBROSEIS TESTS

SPREAD AND VIBRATION POINT CONFIGURATIONS

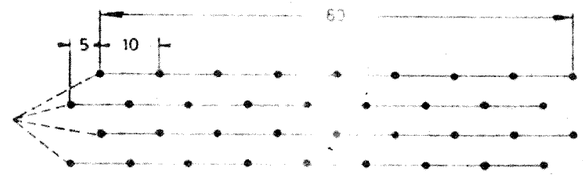


All distances in metres

Lay-out of signal trace I



Lay-out of signal trace II



1. INTRODUCTION

Party 127 35 07 of the COMPAGNIE GENERALE DE GEOPHYSIQUE carries out a vibroseis survey on behalf of the COMPANIA PETROLIFERA ITALIANA on its MONTESILVANO concession.

One of the deepest objectives of the survey is the limestone of the Miocene formation which is expected to be found between 2 and 3 seconds TWT.

Exploitation parameters have been studied during a test session held on 04/04/77 with an experimental lay-out located in the northern part of the prospect (see figure 1) and on 05/04/77 with the exploitation lay-out of the line MS 1.

This very same day, the first exploitation records were performed on the line MS 1, as a start of the survey.

2. EXPERIMENTAL LAY-OUT

See figure 2.

2.1. Recording spreads

48 traces laid-out as follows:

- 24 noise traces, 10 m between traces, each trace being a cluster of 9 geophones.
- 12 signal traces, 20 m between traces, each trace being "H" shaped with 36 geophones.
- 12 signal traces, 20 m between traces, each trace being "rectangular" with 36 geophones.

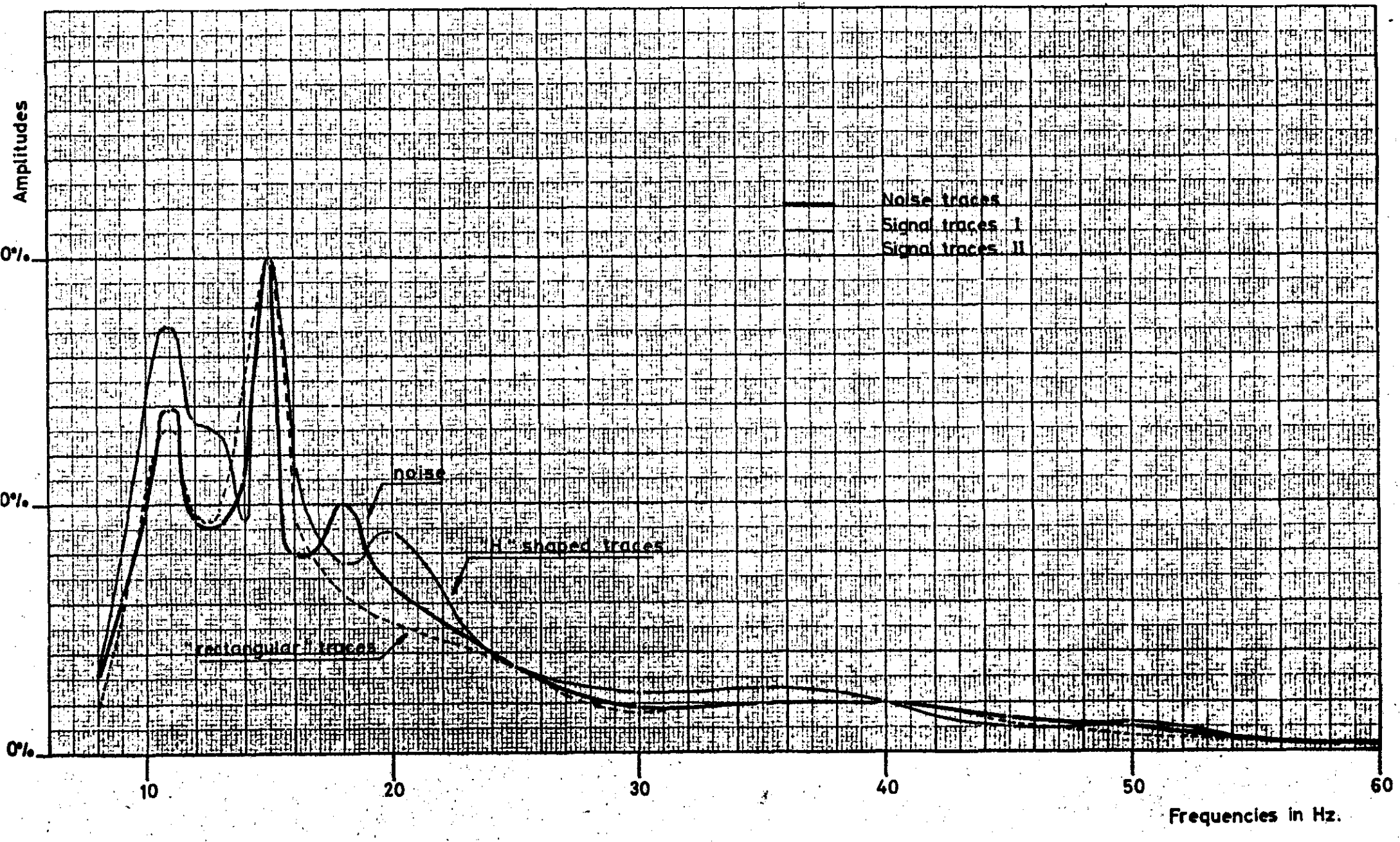
2.2. Vibration points

13 vibration points lined up with the recording spreads and spaced 240 m apart.

Fig: 3

AMPLITUDES VERSUS FREQUENCIES

(Around 3,6 sec.)



3. SWEEP STUDY

In order to define the sweep frequency range, 3 vibrators were gathered on VP 2, and emitted a set of constant frequencies: 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 25, 30, 35, 40, 45, 50, 55, 60 Hz, each frequency being recorded for 6 sec.

Curves drawn on figure 3 show the ground average response amplitude versus frequencies for the 3 types of traces.

A frequency of 15 Hz yields the maximum of energy.

For higher frequencies, the energy decreases quickly, coming practically to naught further than 50 Hz.

For lower frequencies, energy level remains acceptable down to 10 Hz, but decreases steeply after.

It is noticeable that low frequency harmonics do not appear even at 8 Hz.

According to these results, a 48-10 Hz sweep has been selected to perform the remaining tests (noise test, vibrator spacing).

4. LONGITUDINAL NOISE STUDY

Vibration points ranging from VP 1 to VP 13 (see figure 2); on each point 3 vibrators clutched together emitted 4 sweeps 48-10 Hz, each sweep lasting 10 seconds.

Records lined up are used like a noise test recorded on a long spread. See scheme of results on figure 4.

Organised noises, as a whole, are "ground-roll" type; velocities range from 350 m/s to 900 m/s; wave lengthes range from 28 m to 59 m; average wave length is 43 m.

Fig: 4

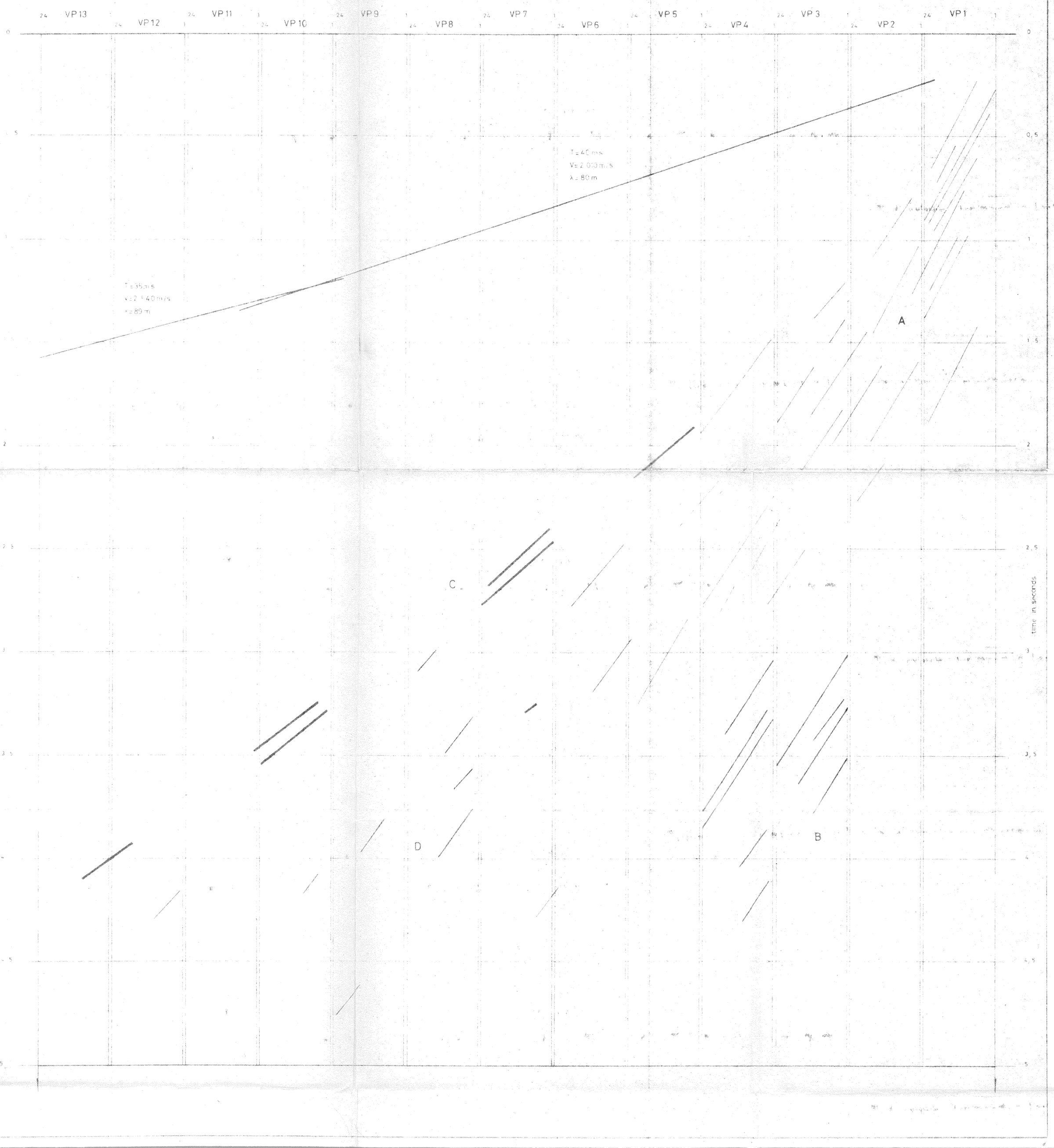
NOISE ANALYSIS

A
T from 70 to 85 ms
V from 350 to 450 m/s
λ from 28 to 32 m

B
T = 55 ms
V from 430 to 450 m/s
λ = 82 m

C
T from 45 to 70 ms
V from 550 to 900 m/s
λ from 40 to 53 m

D
T from 45 to 50 ms
V from 480 to 510 m/s
λ from 26 to 33 m



These wave lengthes are rather short and it looks easy to dump the corresponding noises (A, B, C, D) with a vibrator spacing well chosen.

5. LATERAL NOISE STUDY

A vibration station was located 500 m perpendiculary to the middle of the recording spreads (see figure 2); there one vibrator emitted 8 sweeps (48-10 Hz) lasting 10 seconds.

The record did not show up any evidence of lateral noise, thus, the lateral spreading of the trace and of the vibration station (impossible to realize in most practical cases) is not necessary.

6. SPACING BETWEEN VIBRATORS STUDY

The goal is to define the best space filter against longitudinal organised noises considered as a whole, by the study of the filtering effect of a variable in-line spacing between vibrators along the line.

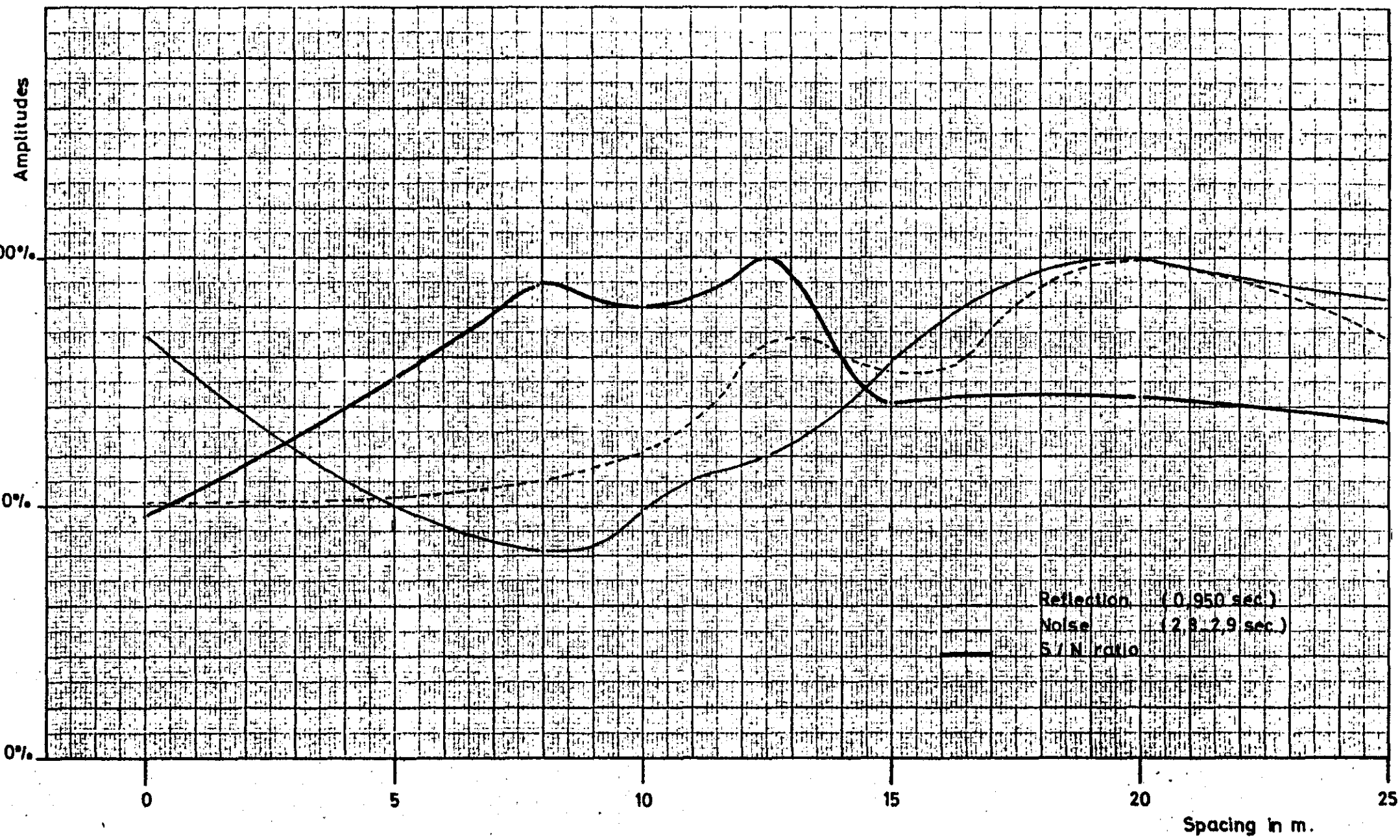
VP 4 was chosen as an emission point for there the ground-roll-like noise appeared to be the most damaging for the signal.

The 3 vibrators, at first clutched together, were then spaced apart each other with the successive in-line distances which follow: 5, 8, 10, 12.5, 15, 20 and 25 m.

For each distance, 4 sweeps (48-10 Hz, 10 sec.) were recorded at fixed gain. Amplitudes of the noise (on noise traces) and of a reflection (on "H" shaped traces)

Fig: 5

AMPLITUDES VERSUS SPACING BETWEEN VIBRATORS



have been measured, averaged and plotted on figure 5, as well as the corresponding values of S/N ratio.

These curves show:

- a minimum of noise for a spacing of 8 m and a maximum for a spacing of 20 m.
- a first maximum of signal for a spacing of 12.5 m and a second one for a spacing of 20 m.
- a first maximum of S/N ratio for a spacing of 8 m and a second one for a spacing of 12.5 m.

This last reason and a close examination of the records lead to choose 12.5 m as an in-line spacing between vibrators.

7. CHOICE OF THE GEOPHONE PATTERN

Regarding to the filtering effect, the "H" and the "rectangle" shaped traces (see figure 2) are equivalent. However, the "H" shaped trace (36 geophones in 2 lines) has been retained due to its greater handyness for laying-out and for having its barycenter located at the trace connection plug of the main cable.

8. CHOICE OF THE VIBRATION PATTERN

Basic parameters have been already settled (sweep frequency range, vibrator spacing); the number of sweeps per VP remains to be fixed up.

Comparison tests between 4 and 8 sweeps per VP were performed at VP 3 and VP 4.

4 sweeps per VP proved energically insufficient, thus, 8 sweeps per VP were retained, leading to $\frac{50}{8} = 6.25$ m between vibration places.

By the way, the low frequency of the sweep was moved up to 12 Hz due to safety reasons and without jeopardizing the signal.

Moreover, the vibrator spacing was checked: a comparison test between 8, 10, 12.5 and 15 m spacings was performed, showing that the 12.5 m spacing was the most suitable regarding to its filtering effect.

9. TESTS WITH THE EXPLOITATION LAY-OUT; CHOICE OF THE SPREAD

On line MS 1, "H" shaped traces, 50 m between traces as requested by C.P.I., 8 sweeps per VP, sweep length: 9 sec., record length: 6 sec.

9.1. Sweep down or up

End shot, 12.5 m spacing between vibrators; sweep down record bears more low frequencies and is slightly stricken by low frequencies harmonics; thus a sweep up was retained for the following records.

9.2. 12-48 or 12-56 Hz sweep

End shot, 12.5 m spacing between vibrators; sweep up; getting more high frequencies into the sweep range blurs partly the reflections; thus a 12-48 Hz sweep was kept for the following records.

9.3. Spacing between vibrators: 10 or 12.5 or 15 m

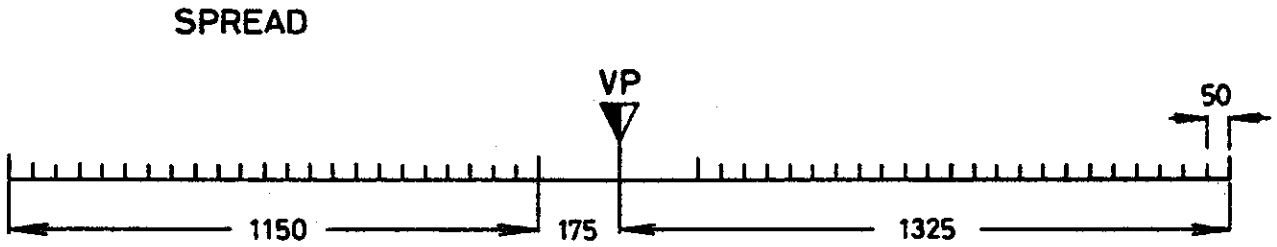
End shot, 12-48 Hz sweep up; the very slight difference between the records still favours the record with 12.5 m between vibrators.

9.4. End shot or split spread

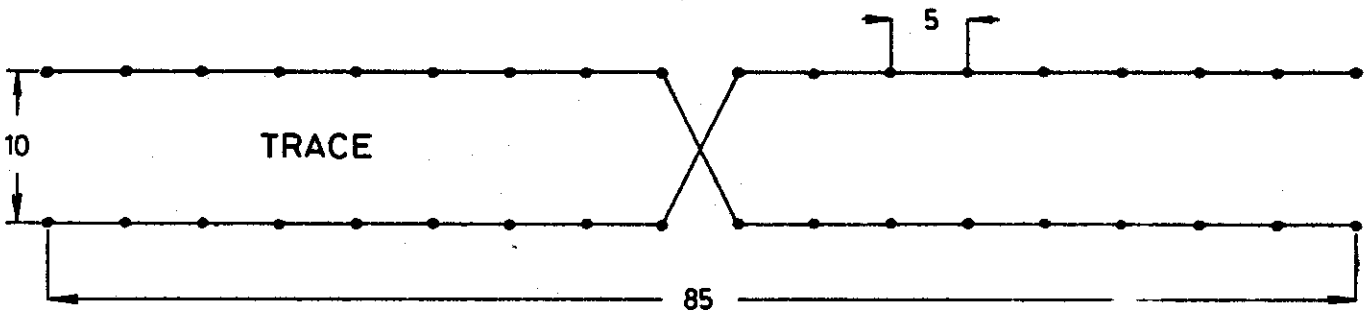
12.5 m spacing between vibrators, 12-48 Hz sweep up; the 3 traces close to the VP are disturbed by the vibrators, uppermost mirrors are nicely caught on most traces of the split spread record while the deepest reflections (3.5 sec.) appear on both records; thus a split spread with a 175 x 2 = 350 m gap was retained for exploitation.

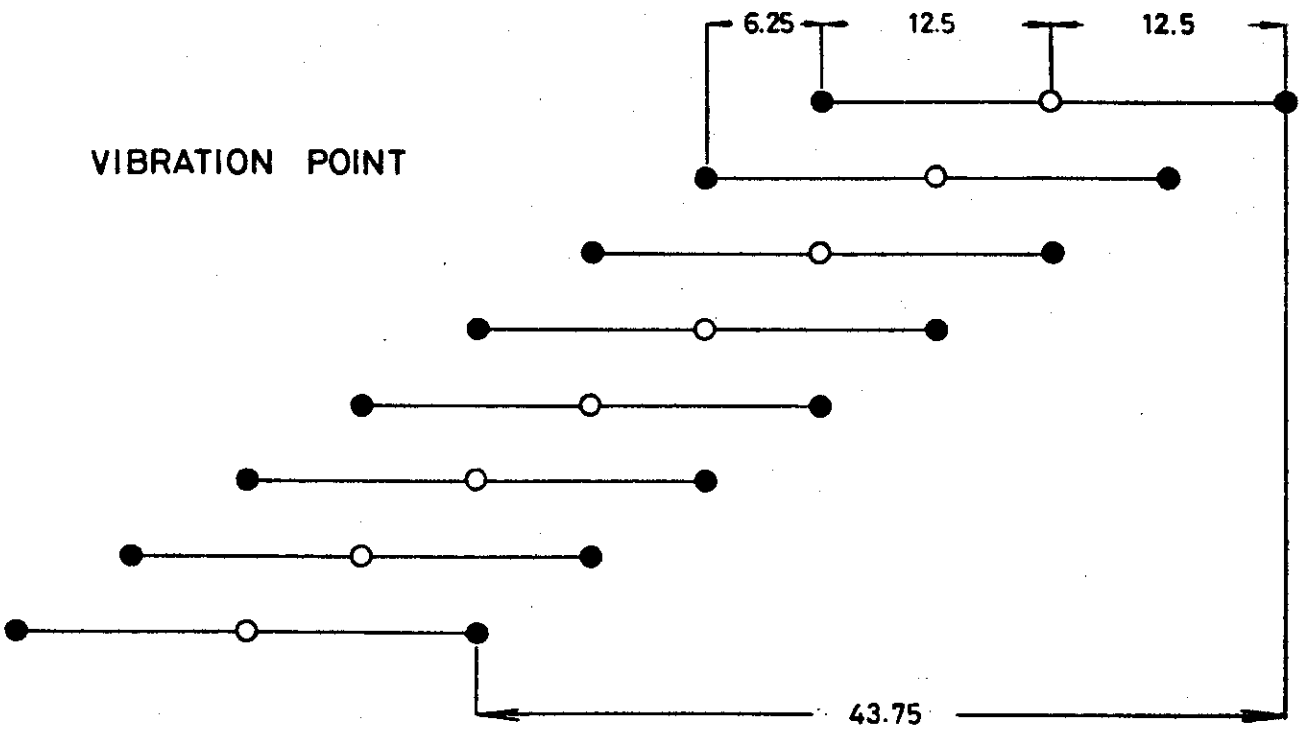
Fig. 6

RECORDING SPREAD



All distances in metres





10. CONCLUSION

Vibroseis tests carried out on 04/04/77 and 05/04/77 allowed the following exploitation parameters to be settled:

10.1. Vibration pattern

- 8 vibration places per VP
- 6.25 m between vibration places
- 3 vibrators, 12.5 m apart each other
- sweep: 12-48 Hz up lasting 9 sec.

10.2. Geophone pattern

- 36 geophones per trace in 2 lines of 18 geophones
- geophone spacing: 5 m

10.3. Lay-out

- split spread of 24 + 24 = 48 traces
- trace spacing: 50 m
- gap: 175 + 175 = 350 m

10.4. Record settings

- record length: 6 sec.
- low cut filter: 10 Hz
- high cut filter: 62.5 Hz
- notch filter: ON

PESCARA (Italy) on 22/04/77

Mr. VINCENT