VARIATION OF AMPLITUDE WITH SWEEP PARAMETERS

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TECHNICAL AND HISTORICAL BACKGROUND

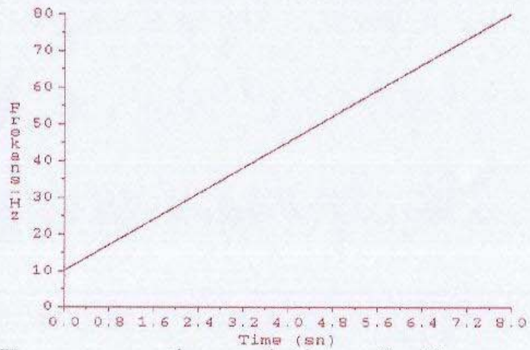
- Vibroseis method was used first time by Continental Oil Co. in 1957.
- Vibroseis method was used in Europe in 1963 and in TPAO/ Turkey in 1976.
- Vibrator is a controlled energy source employed in seismic reflection method.
- Vibroseis is a specific variant of the seismic method, whose major function is to determine the nature and configuration of rock layers deep in the earth.
- Vibroseis has been used for some very interesting academic exercises.

A VIEW OF VIBRATOR

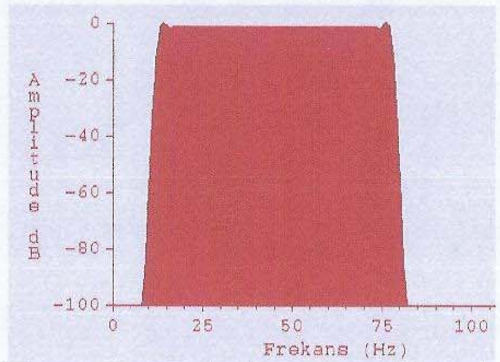
Vibrator sending sweep into the earth is an engine.

WHAT IS SWEEP ?

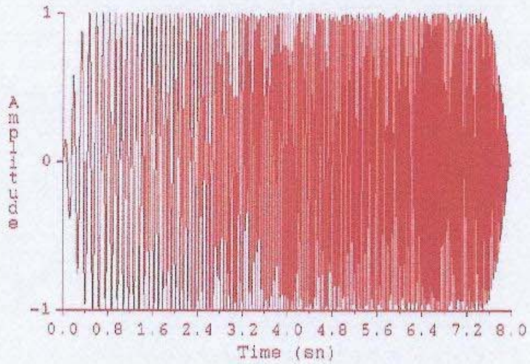
Sweep is a signal which is sends into the earth by vibrator.



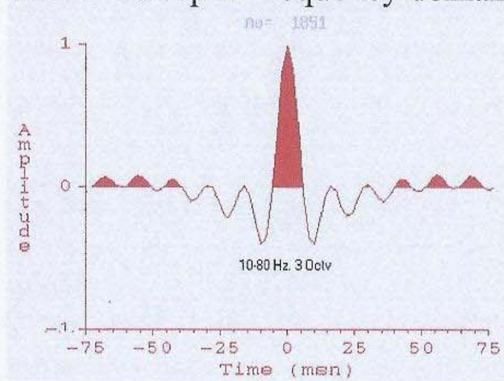
Frequency-time relation of a linear sweep



Linear sweep in frequency domain



Linear sweep in time domain



Autocorrelation of sweep

VARIATION OF PEAK AMPLITUDES WITH NUMBER OF SWEEP

The amplitude of wavelet is proportional to the square of sweep number

NS : Number of Sweep, A_o :The amplitude of autocorrelation of one sweep

$NS_1=1$ for Amplitude $A_1 = A_o$

$NS_2=2$ for Amplitude $A_2 = 4A_o$

$NS_a=a$ for Amplitude $A_a = a^2 A_o$

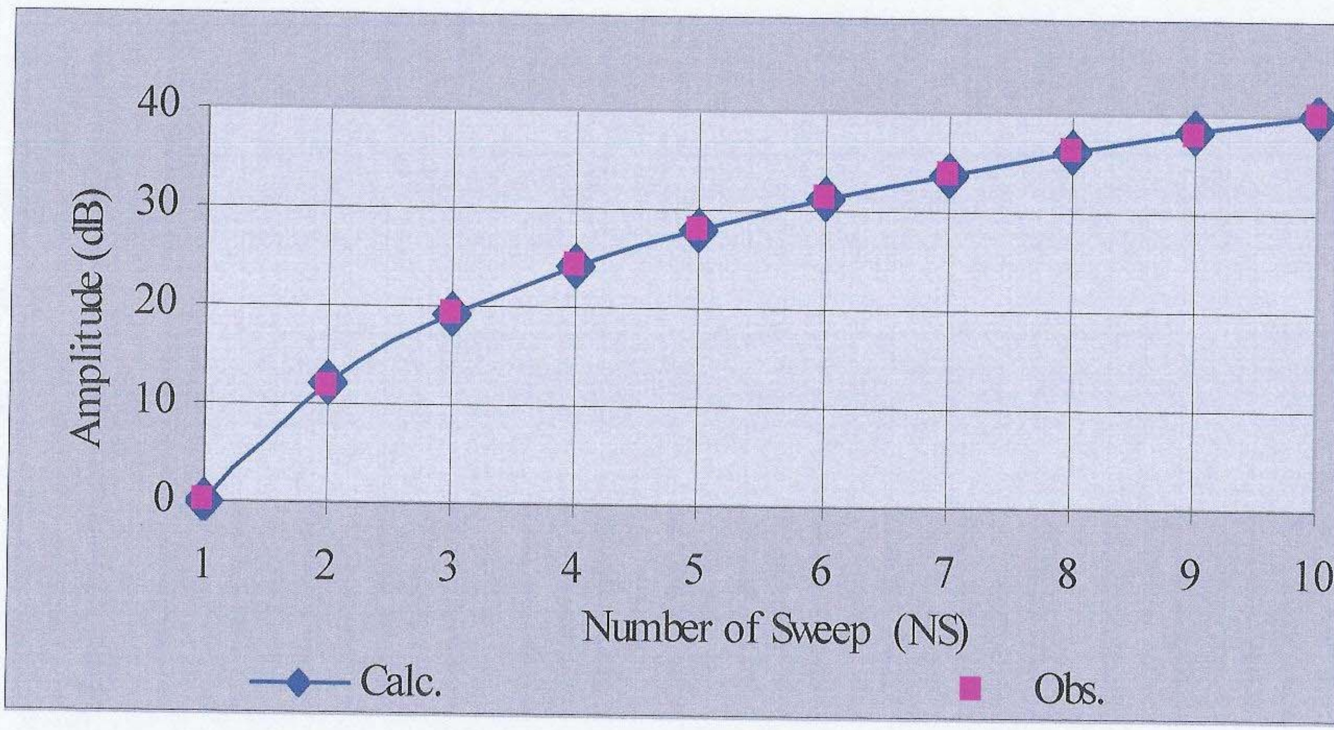
If the amplitude of autocorrelation of one sweep is A_o, the amplitude of autocorrelation of a sweeps will be $a^2 A_o$

Amplitude dB=20 $\log(A_a/A_1) = 20 \log(a^2) = 40 \log(a)$

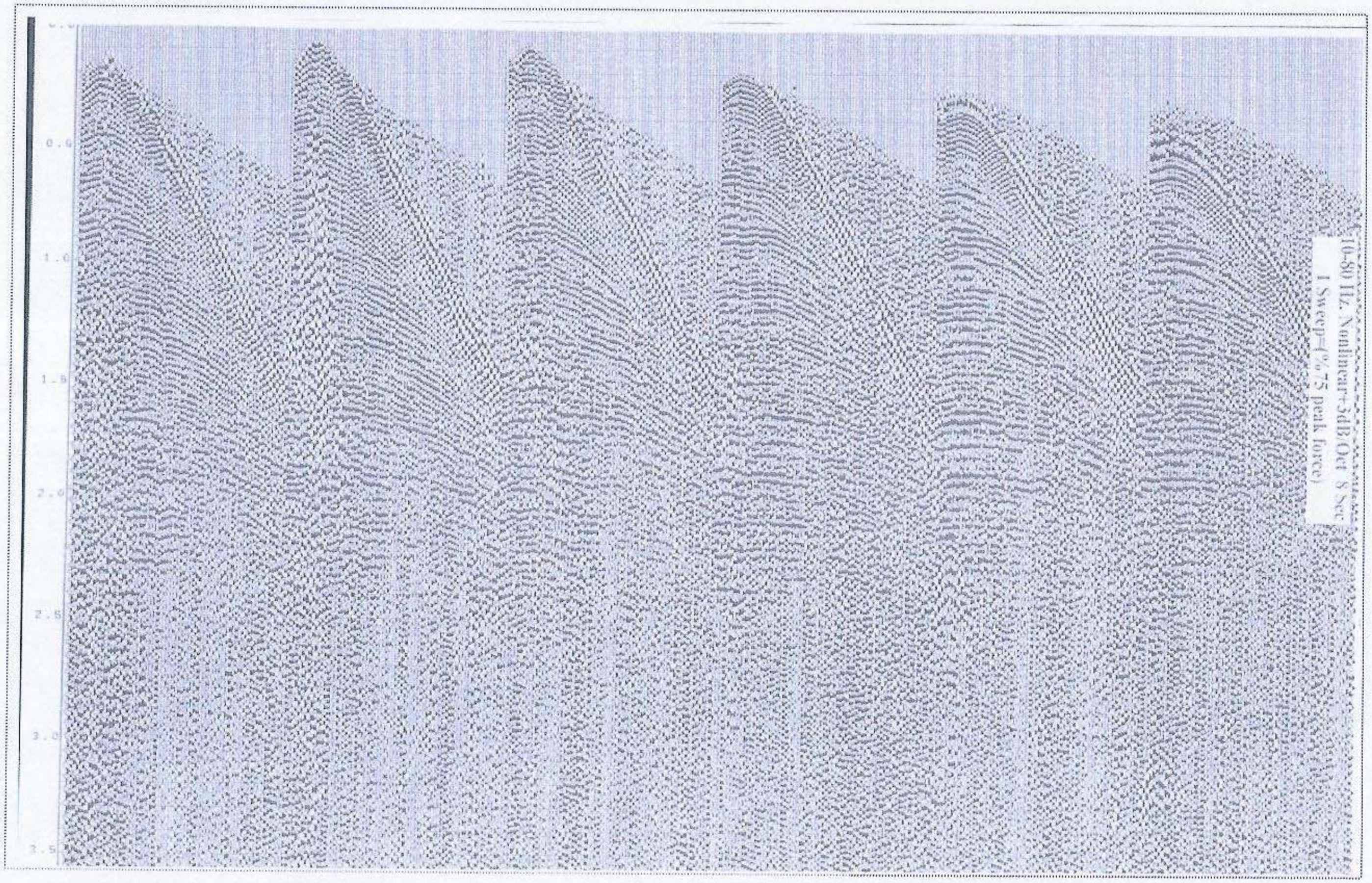
The increase in amplitude is 40 log(a) dB, where a: number of sweep

S/N Improvement 20 log $(a)^{0.5}$

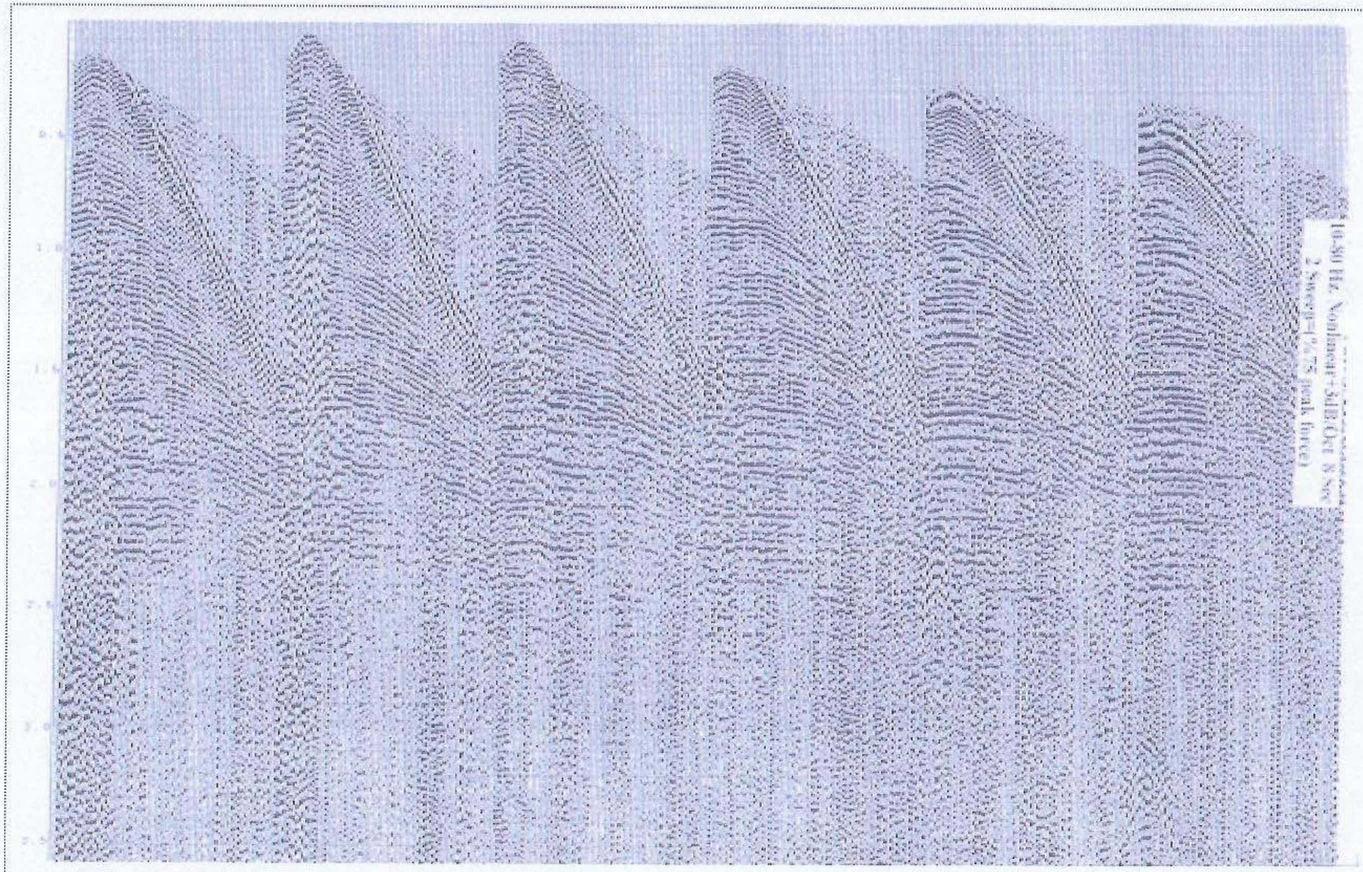
VARIATION OF PEAK AMPLITUDES WITH NUMBER OF SWEEP



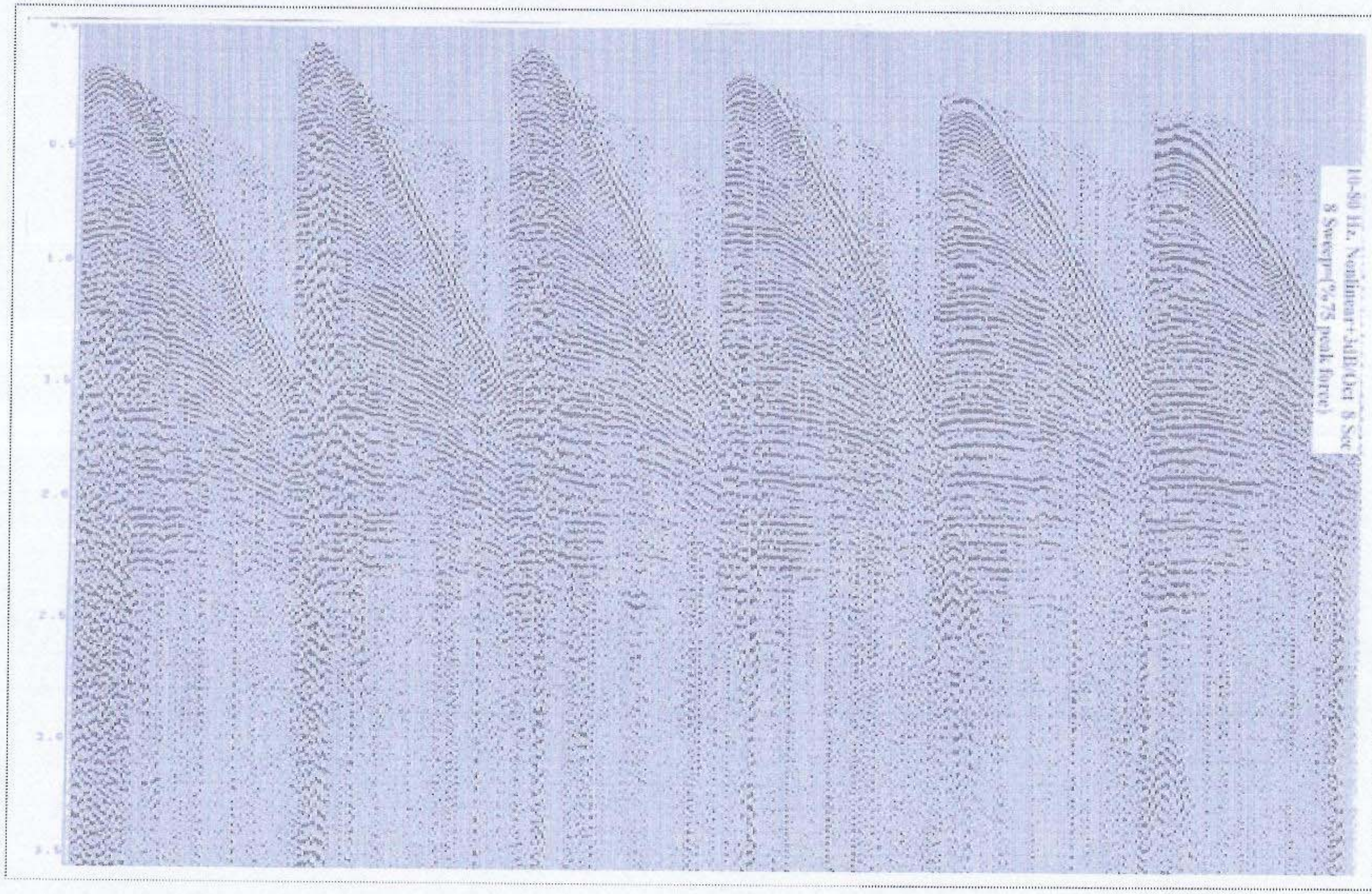
VARIATION OF PEAK AMPLITUDES WITH NUMBER OF SWEEP
1 sweep



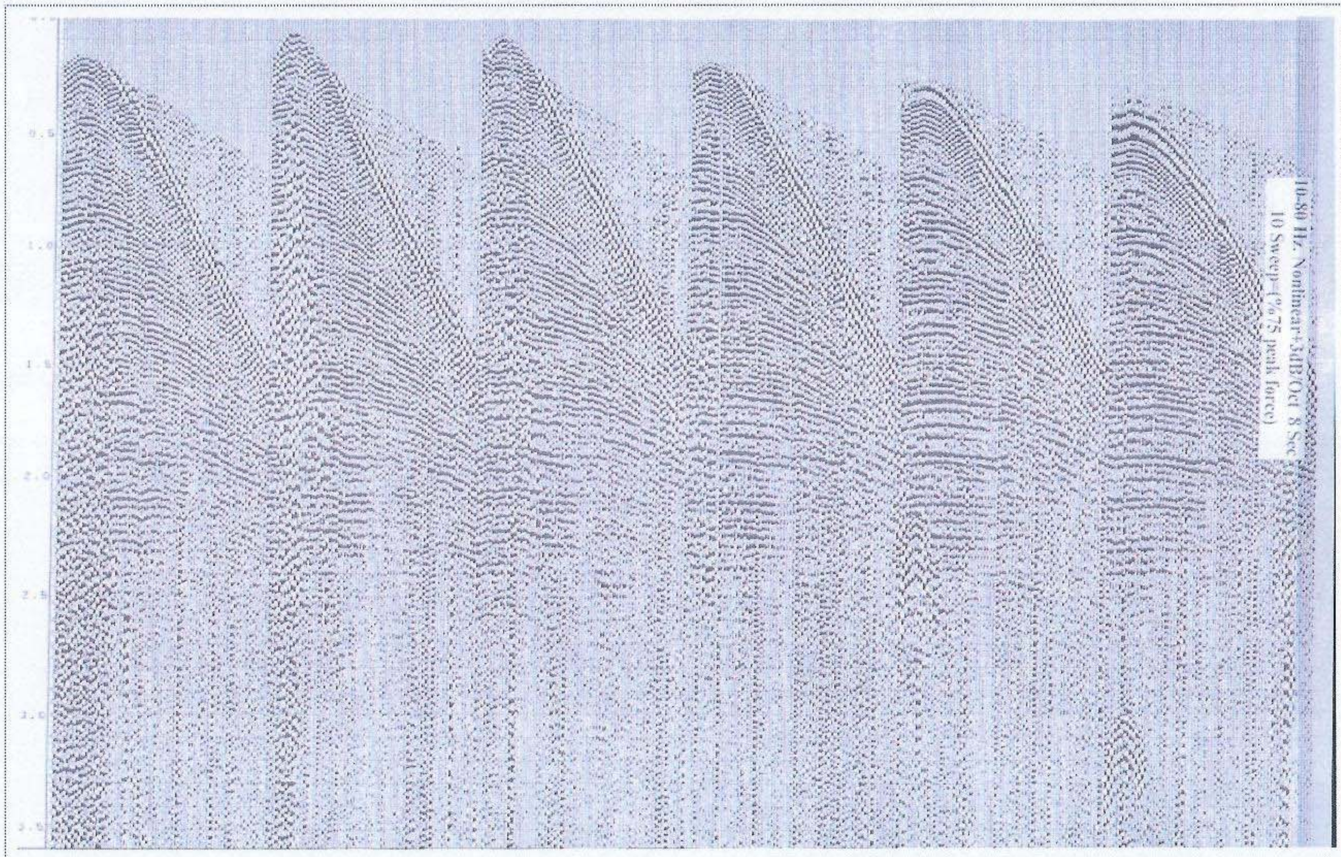
VARIATION OF PEAK AMPLITUDES WITH NUMBER OF SWEEP
2 sweeps



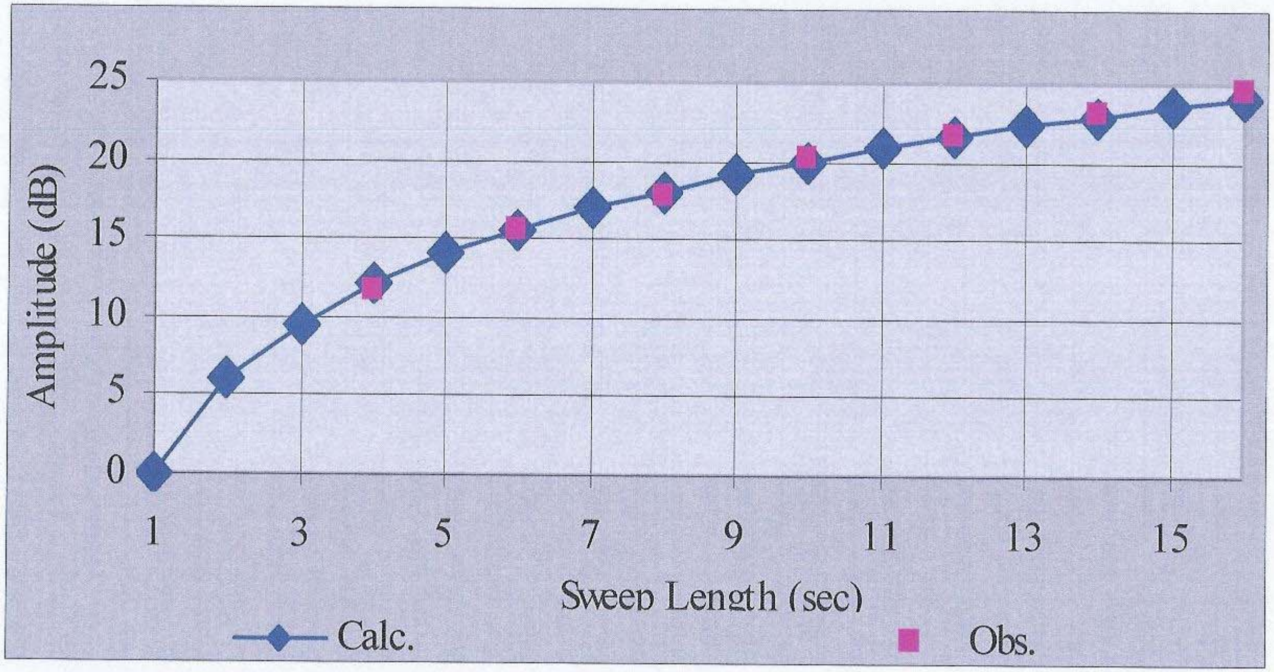
VARIATION OF PEAK AMPLITUDES WITH NUMBER OF SWEEP
8 sweeps



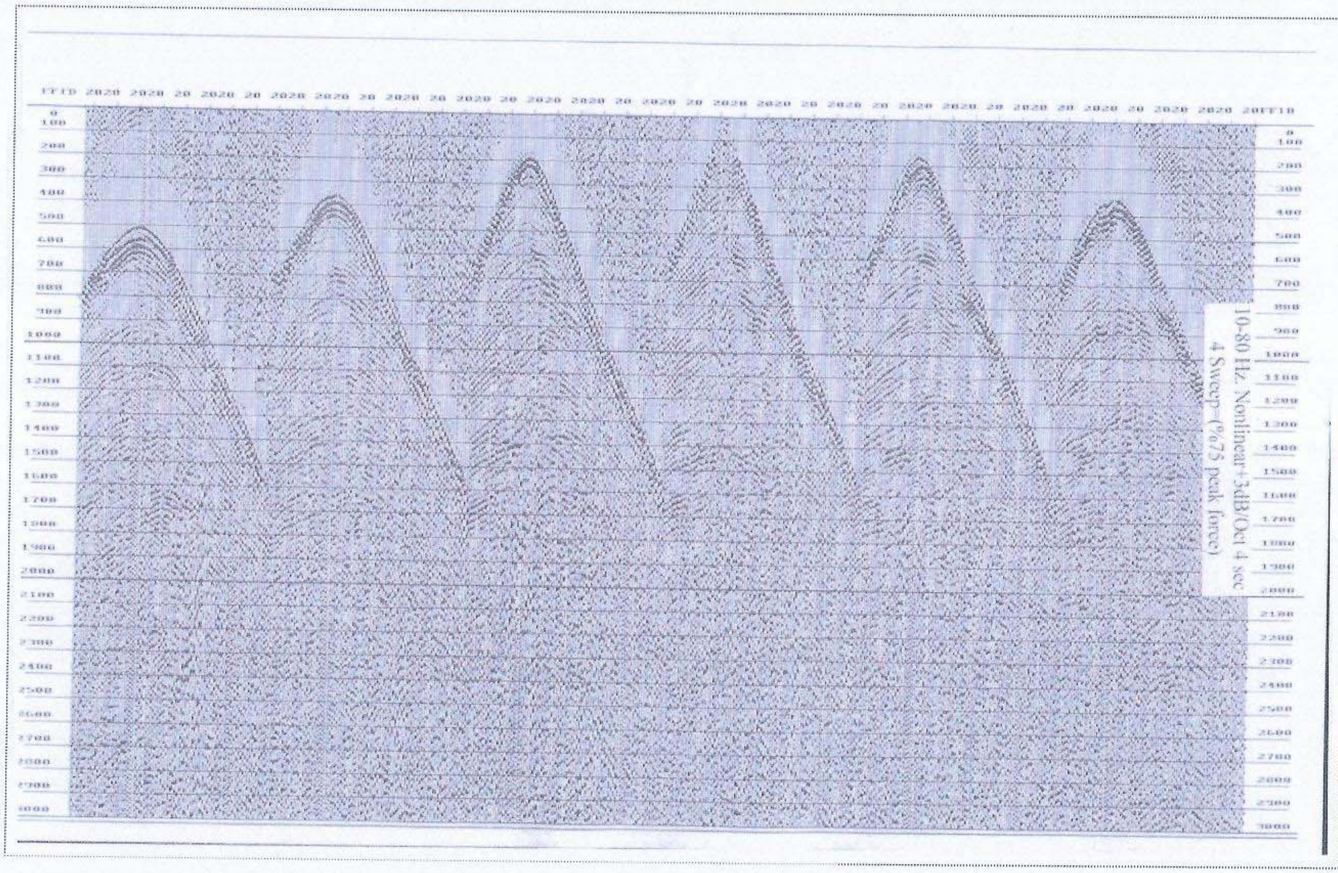
VARIATION OF PEAK AMPLITUDES WITH NUMBER OF SWEEP
10 sweeps



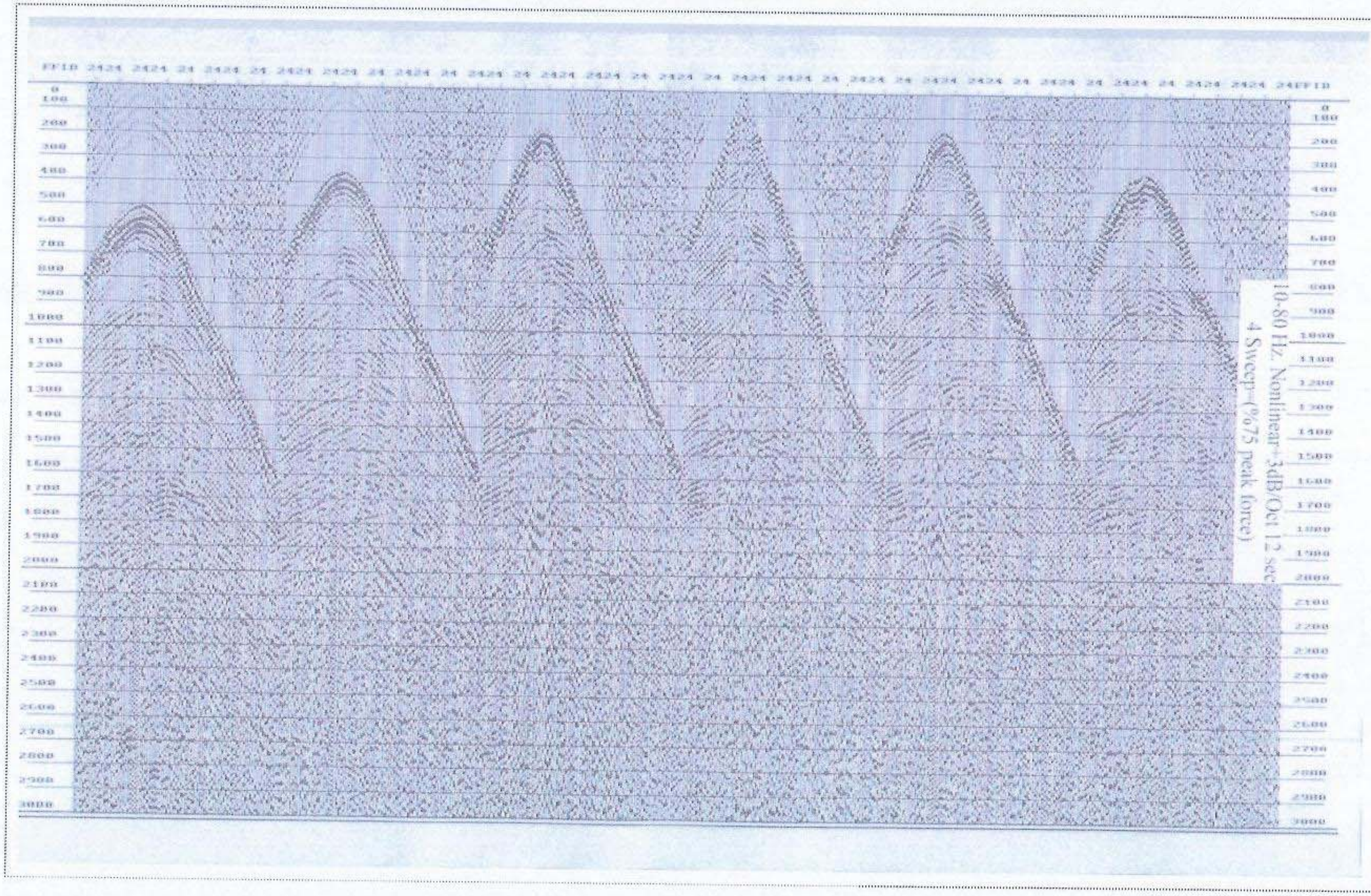
VARIATION OF PEAK AMPLITUDES WITH SWEEP LENGTH



VARIATION OF PEAK AMPLITUDES WITH SWEEP LENGTH
4 sec



VARIATION OF PEAK AMPLITUDES WITH SWEEP LENGTH
12 sec



VARIATION OF PEAK AMPLITUDES WITH PEAK-FORCE

The amplitude of wavelet is proportional to the Peak-force

PF : Peak-Force (%), A_o : Amplitude of autocorrelation wavelet having Peak-Force %

$PF_1=0.5$ for Amplitude $A_1 = 0.5A_o$

$PF_2=0.7$ for Amplitude $A_2 = 0.7A_o$

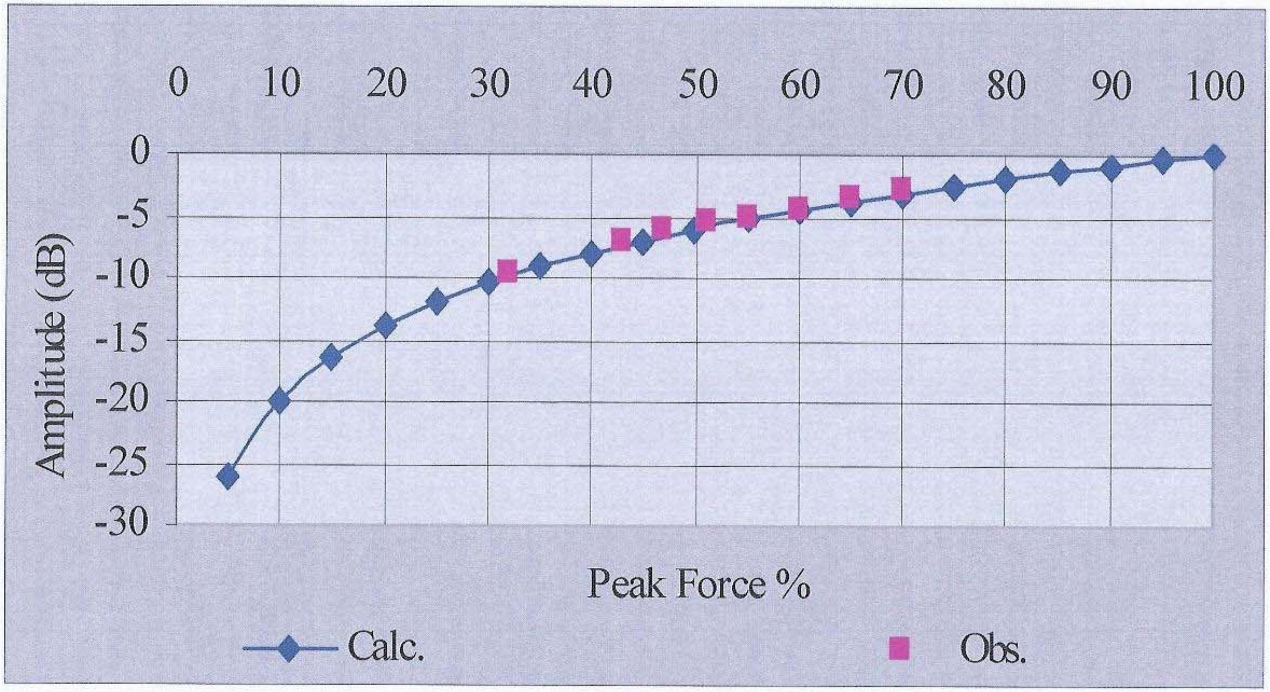
$PF_c = c$ for Amplitude $A_c = c\,A_o$

Amplitude dB=20 log(%Peak-Force) = 20 log (c)

If peak-force can transmit its full force (100%) into the earth, the amplitude of the autocorrelation of the wavelet will be dB=20*log(100/100)= 0 dB. In other words, there is no variation in term of the amplitude. If the vibrator can transmit 50% of its force into the ground the corresponding amount will be dB=20*log(50/100)= -6 dB. This means the amplitude of the autocorrelated wavelet decreases 6 dB compared with the previous amplitude.

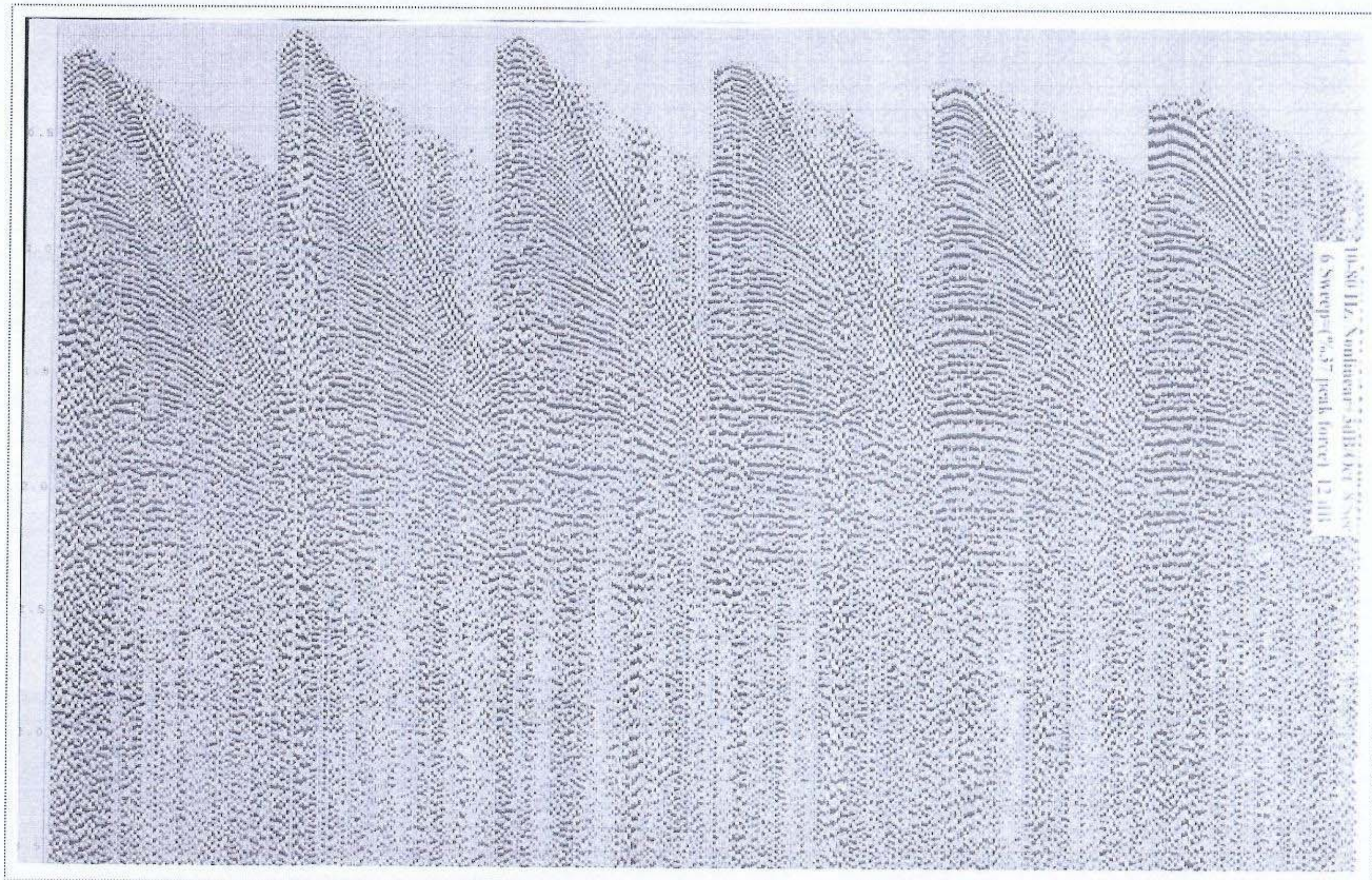
S/N Improvement 20 log $(c)^{0.5}$ where c: Peak-Force %

VARIATION OF PEAK AMPLITUDES WITH PEAK-FORCE

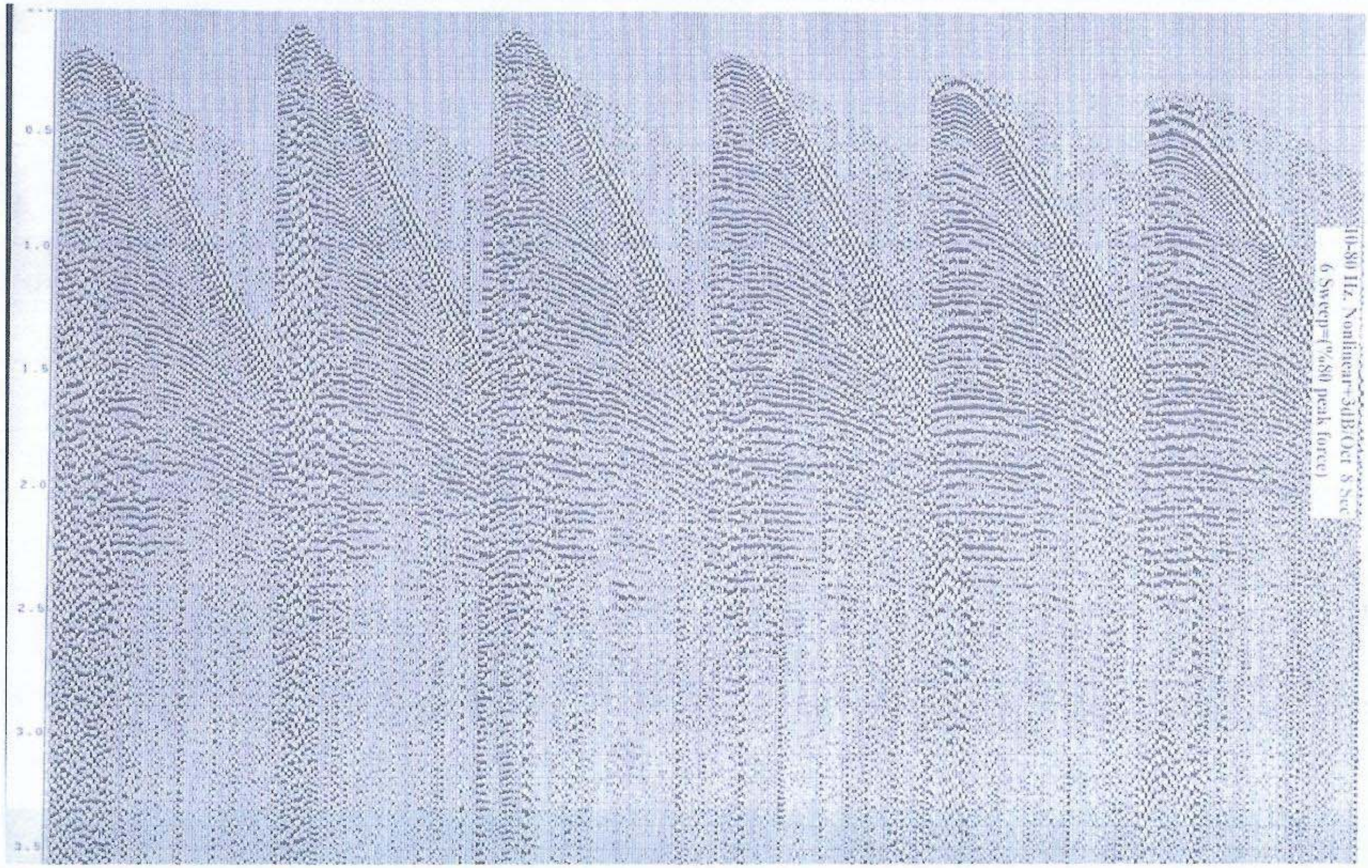


VARIATION OF PEAK AMPLITUDES WITH PEAK-FORCE

Peak Force 33 %

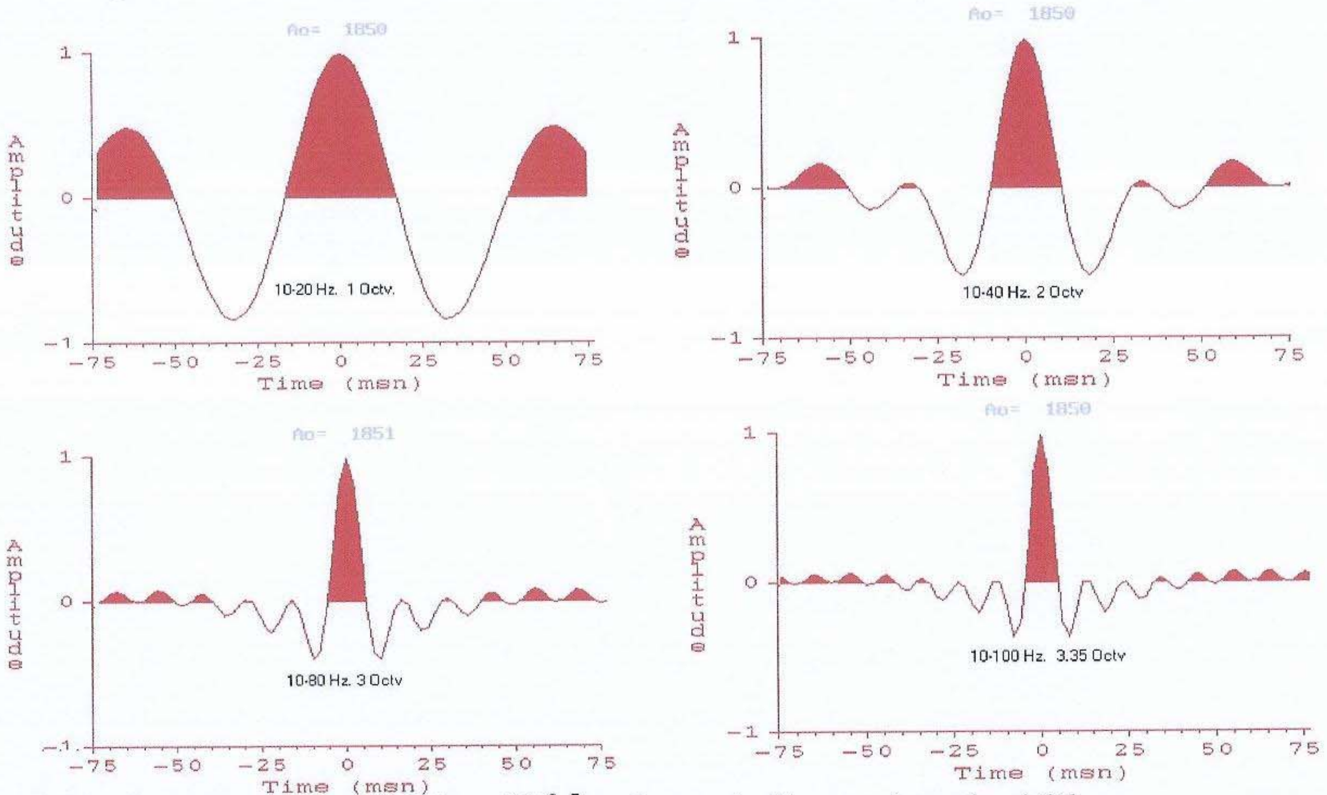


VARIATION OF PEAK AMPLITUDES WITH PEAK-FORCE
Peak Force 70 %



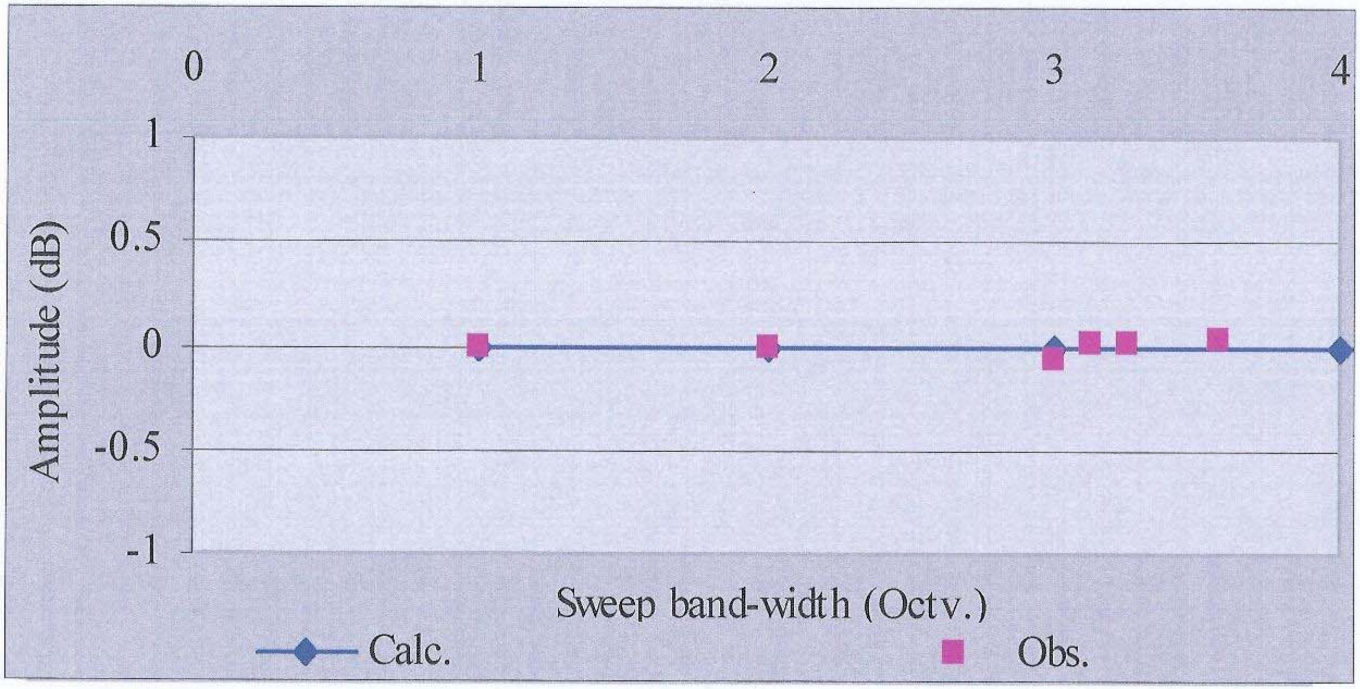
VARIATION OF PEAK AMPLITUDES WITH SWEEP BAND-WIDTH

The amplitude of wavelet is not variation with sweep band-width



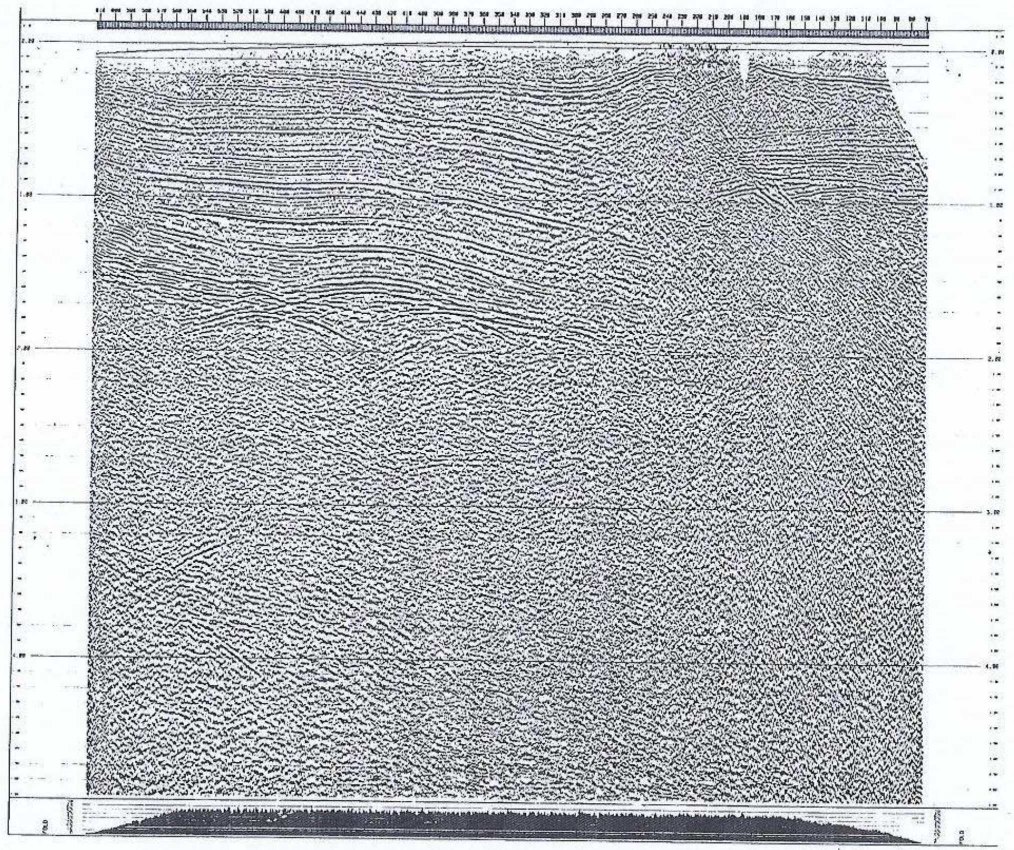
S/N Improvement 20 log $(d)^{0.5}$ where d: Sweep band-width

VARIATION OF PEAK AMPLITUDES WITH SWEEP BAND-WIDTH



EXAMPLE OF SEISMIC SECTION WITH _4 SWEEPS_

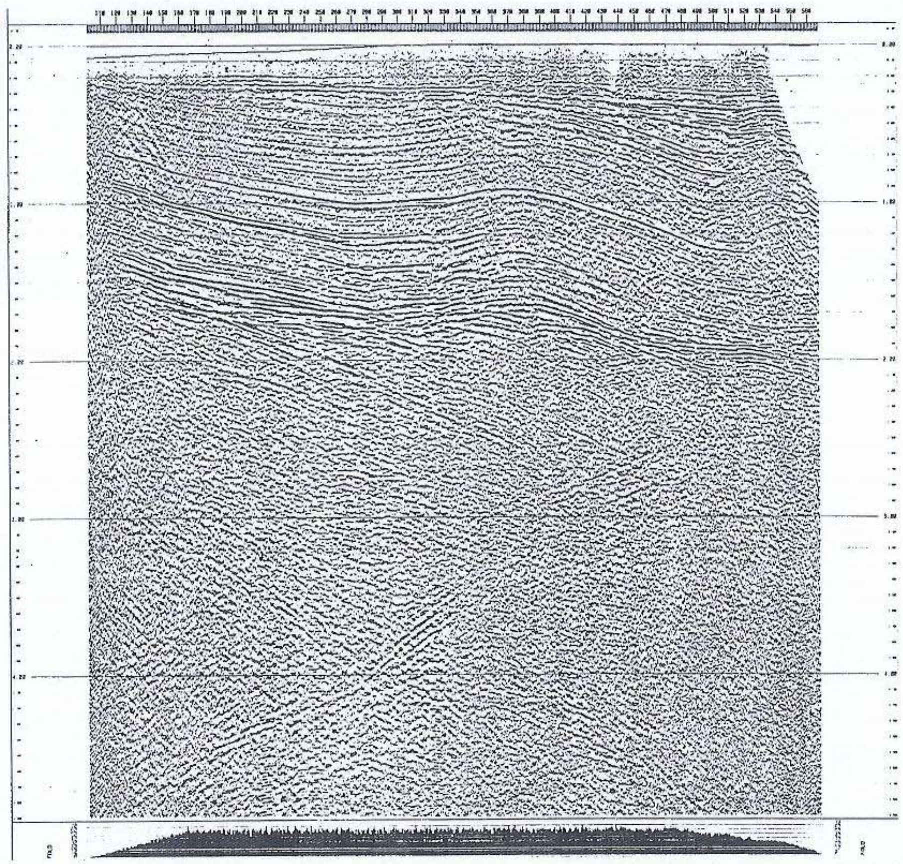
Line-A Structure (10-72 Hz. 8 sec. Linear)



C:\>orhan\TURKIOG2000.PPT Speaker : Orhan GÜRELİ

EXAMPLE OF SEISMIC SECTION WITH *6 SWEEPS*

Line-B Structure (10-72 Hz. 8 sec. Linear)



RESULTS

$Ao = a^2 \cdot b \cdot c = 1$ Amplitude $Ao = 0$ dB

Where

a=1	:	Number of sweep
b=1 sec	:	Sweep length
c= 100%	:	Peak-Force

$Ao = a^2 \cdot b \cdot c = 106{,}56$ Amplitude $Ao = 40{,}55$ dB

Where

a=6	:	Number of sweep
b=8 sec	:	Sweep length
c= 37 %	:	Peak-Force

Total Time : 6swp*(8sec+5sec)=78 sec

$Ao = a^2 \cdot b \cdot c = 108{,}8$ Amplitude $Ao = 40{,}73$ dB

Where

a=4	:	Number of sweep
b=8 sec	:	Sweep length
c= 85 %	:	Peak-Force

Total Time : 4swp*(8sec+5sec)=52 sec

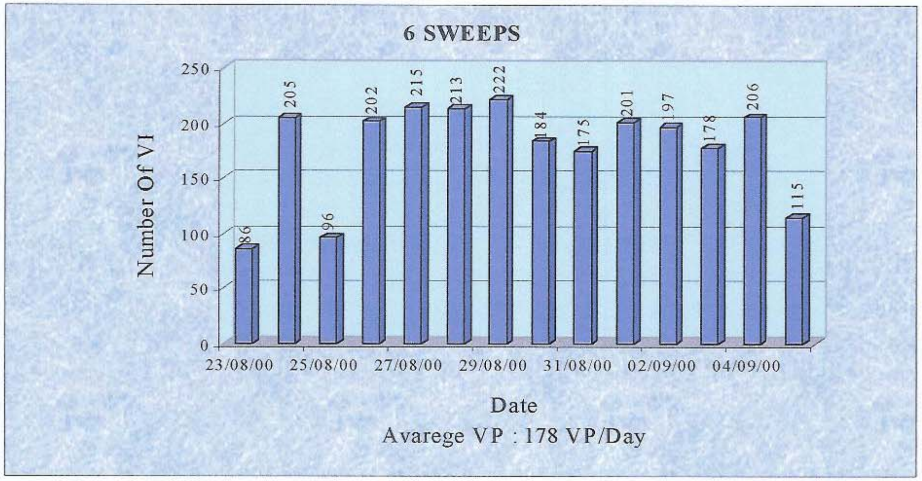
Vibrator moving time : 35 sec

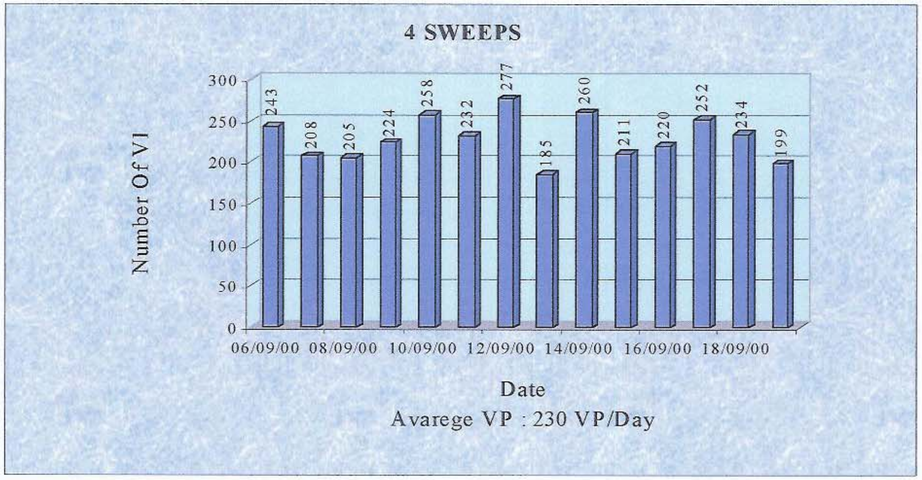
Total time per shot:

For 6 sweeps	=(78 sec+35 sec)= 113 sec
For 4 sweeps	=(52 sec+35 sec)= 87 sec

Gain: 30%

RESULTS


6 SWEEPS
Number Of VI
Date
Avarege VP : 178 VP/Day


4 SWEEPS
Number Of VI
Date
Avarege VP : 230 VP/Day

RESULTS

$Ao = a^2 . b . c = 1$ Amplitude $Ao = 0$ dB

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