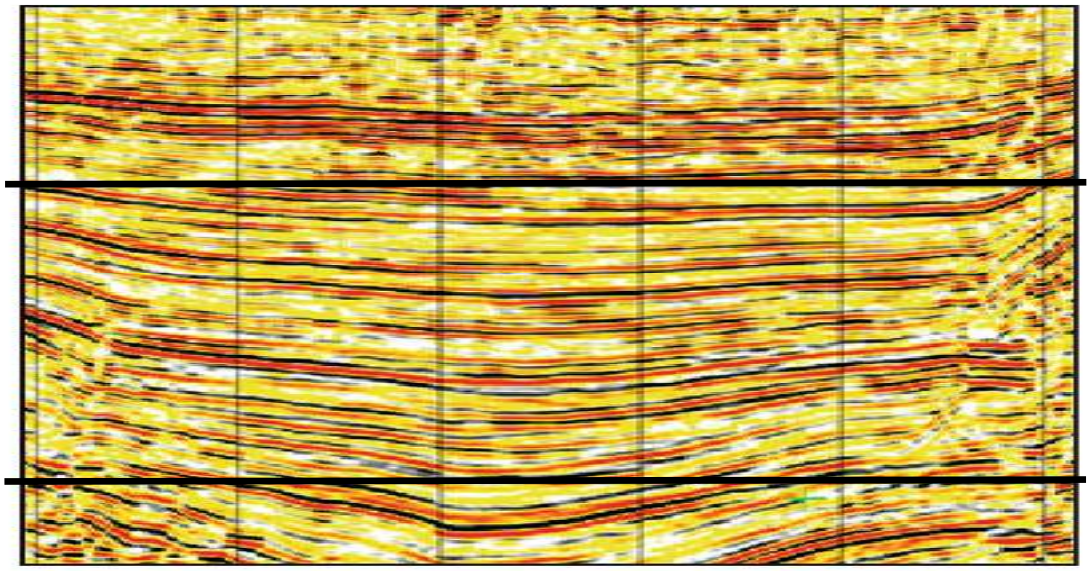
(a)

Depth(m.)

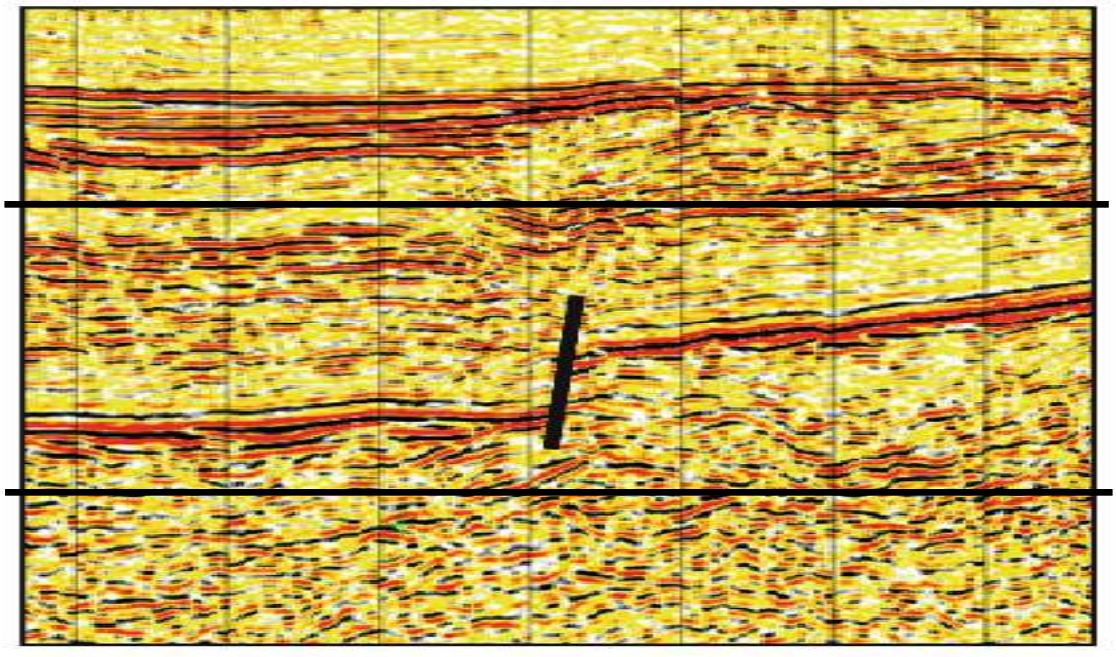
TTWT(ms)

(b)

TTWT(ms)



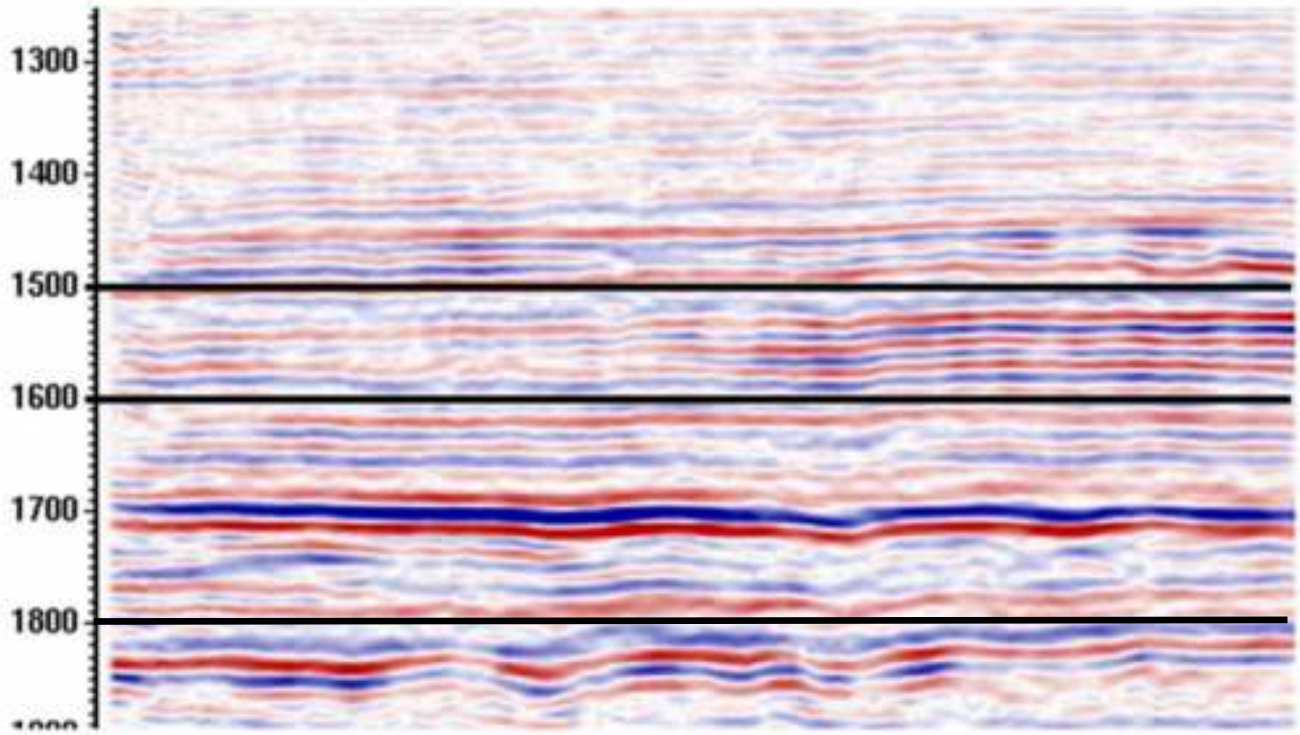
TTWT(ms)



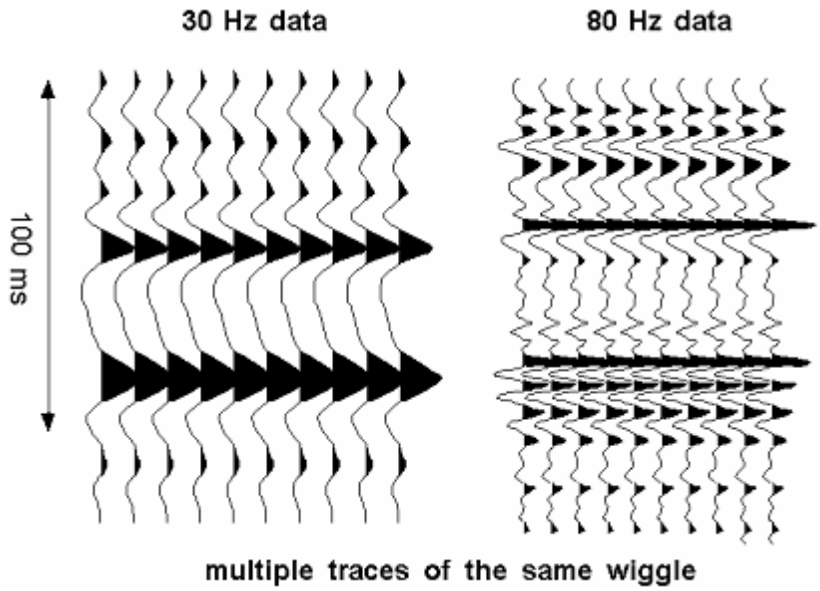
- What is the dominant frequency of the seismic data in the interval between (1500-1600 ms.) and (1600-1800 ms.)?

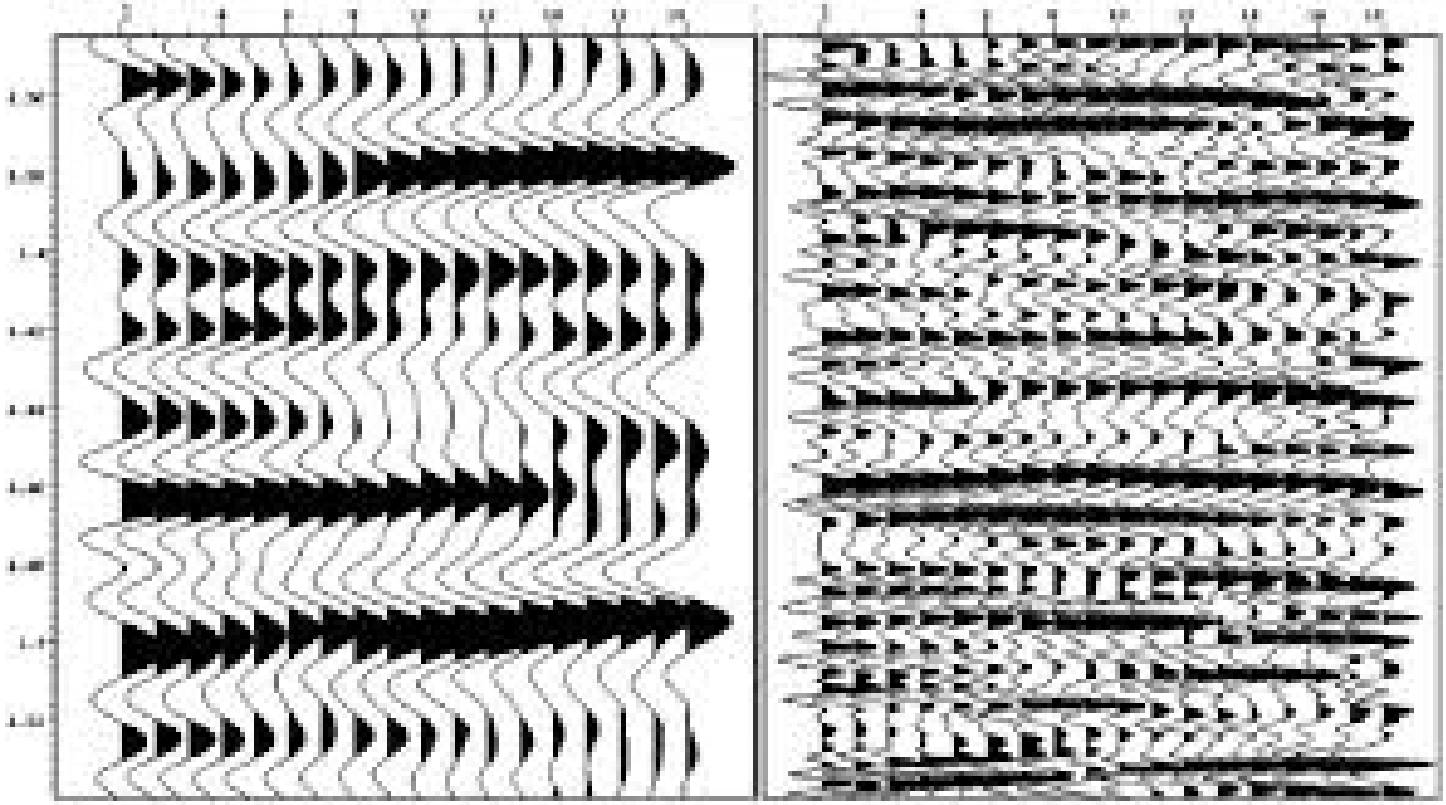
- Suppose the velocity is (5000 m/s) , calculate the wavelength and the small tuning (power of resolution).

Exercise 1:



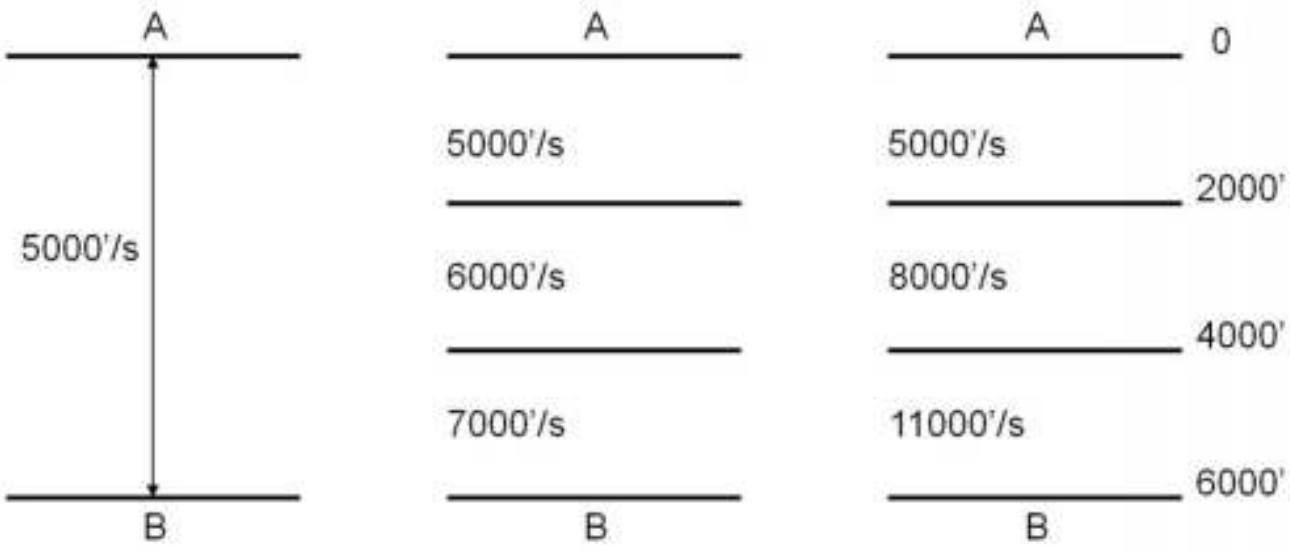
TTWT(ms)





Exercise 2:

Average Velocity and RMS Velocity



Calculate the average velocity for a wave travelling from point A to point B and compare it to the RMS velocity.

Velocities

Interval-Velocity

$$V_I = \frac{z_m - z_n}{t_m - t_n} = \frac{z_m - z_n}{\tau_m}$$

Instantaneous Velocity

$$V_{inst} = \frac{dz}{dt}$$

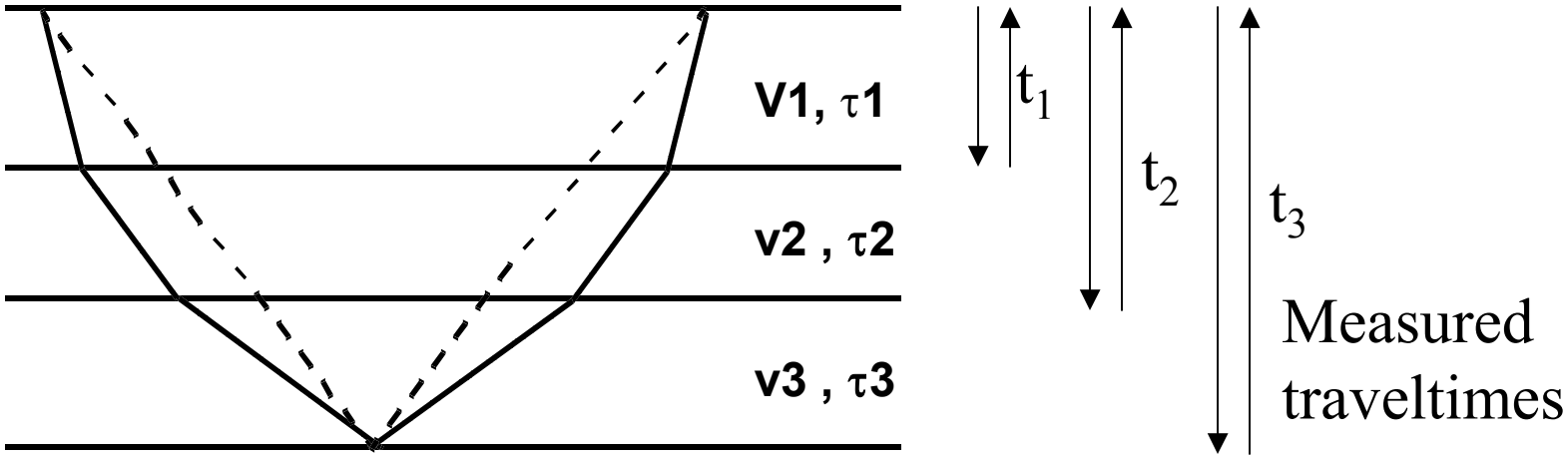
Average-Velocity

$$V_{av} = \frac{\sum_{i=1}^{n} z_i}{\sum_{i=1}^{n} \tau_i} = \frac{\sum_{i=1}^{n} v_i \tau_i}{\sum_{i=1}^{n} \tau_i}$$

t_m : measured reflected ray traveltime

τ_m : one-way reflected ray traveltime only through m^{th} layer

Several horizontal layers



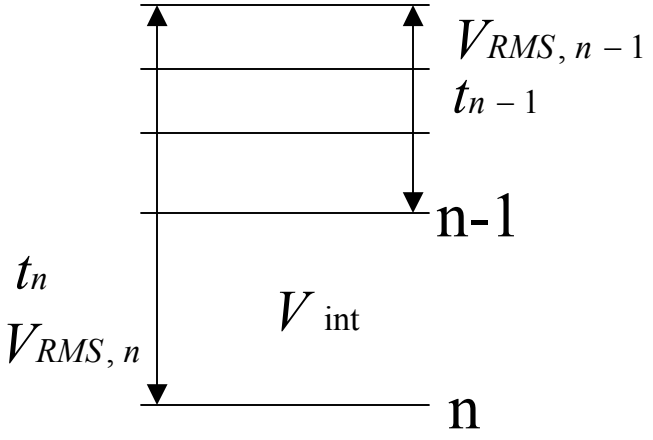
RMS-velocity (root-mean-square)

$$v_{rms}^2 = \frac{\sum_{i=1}^{n} v_i^2 \tau_i}{\sum_{i=1}^{n} \tau_i}$$

Dix' Formula

Conversion from v_{rms} in v_{int} (interval velocities)

$$V_{\text{int}} = \sqrt{\left[\frac{\left(V_{RMS,n}\right)^2 t_n - \left(V_{RMS,n-1}\right)^2 t_{n-1}}{t_n - t_{n-1}}\right]}$$



V_{rms} is approximated by the stacking velocity that is obtained by NMO correction of a CMP measurement.
(when maximum offset is small compared with reflector depth)

Calculating Frequency and Wavelength

- Estimate the frequency of the seismic data in two seismic windows and then calculate the seismic wavelengths.

$$F_{apparent} = N.\ of\ cycles / t \quad \ldots\ldots(1)$$

$$F_{dominant} = (2 \times F_{apparent}) / \pi \quad \ldots\ldots(2)$$

$$\lambda = V / F_{dominant} \quad \ldots\ldots(3)$$

$$Vertical\ Resolution = \lambda / 4 \quad \ldots\ldots(4)$$

$$Horizontal\ Resolution\ (Fresnel\ zone) = V\left((t/2) / F_{dominant}\right)^{0.5} \quad \ldots\ldots(5)$$

where:

$F_{apparent}$ = Apparent frequency (Hz)

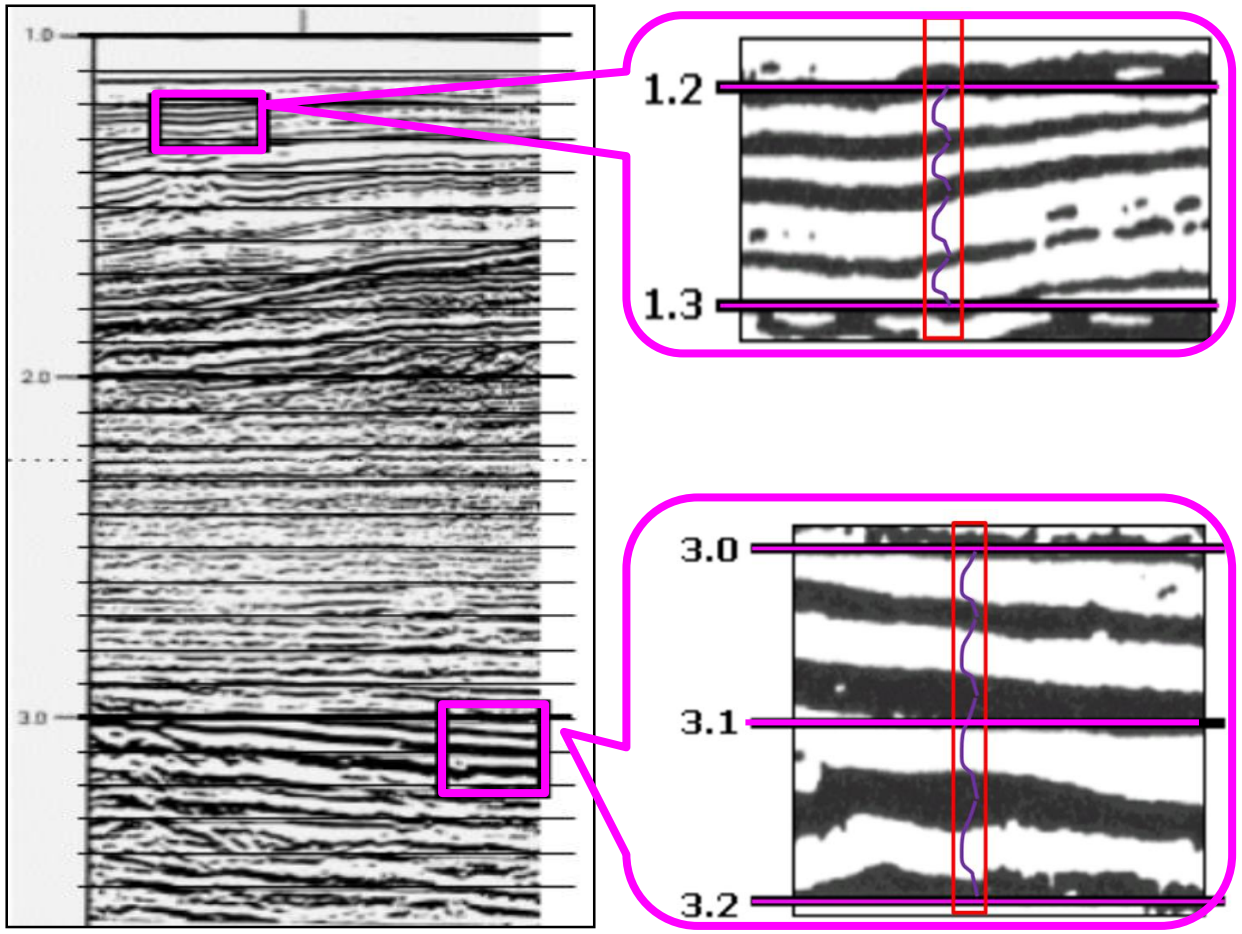
t= time (s)

V= Velocity (m/s)

$F_{dominant}$ = Dominant frequency (Hz)

λ= Wave Length (m)

Calculating Frequency and Wavelength



How many black-white cycles are inside the red box from 1.2 to 1.3 sec?

•Approximately four (4)

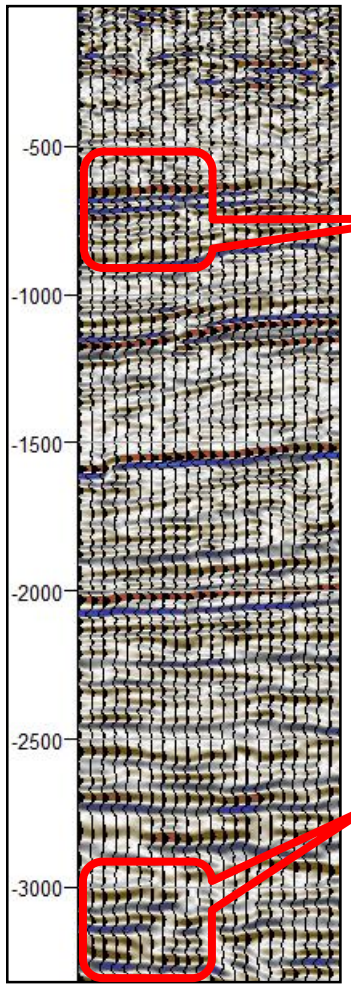
How many black-white cycles are inside the yellow box from 3.0 to 3.2 sec?

•Approximately four (4)

- Shallow Velocity = 2000 m/sec
- Deep Velocity = 4000 m/sec

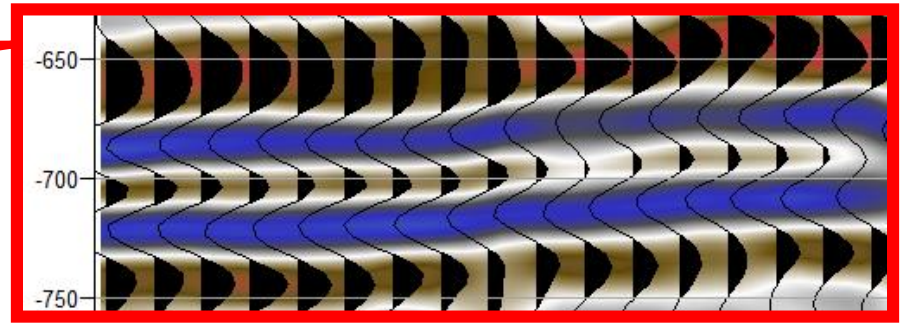
	Shallow Window	Deep Window
Frequency	$F_{apparent}$ = 4/0.1 = 40 HZ $F_{dominant}$ = (2 X 40) / 3.14 = 25.4 HZ	$F_{apparent}$ = 4/0.2 = 20 HZ $F_{dominant}$ = (2 X 20) / 3.14 = 12.7 HZ
Wavelength	λ = 2000 / 25.4 = 78.7 m	λ = 4000 / 12.7 = 315 m
Vertical resolution	λ /4 = 19.7 m	λ /4 = 78.7
Horizontal resolution	$=2000\ (0.65\ /25.4)^{0.5}$ = 320 m	$=4000\ (1.6\ /12.7)^{0.5}$ = 1420m

Calculating Frequency and Wavelength



How many red-blue cycles are inside the red box from -640 to -750 ms?

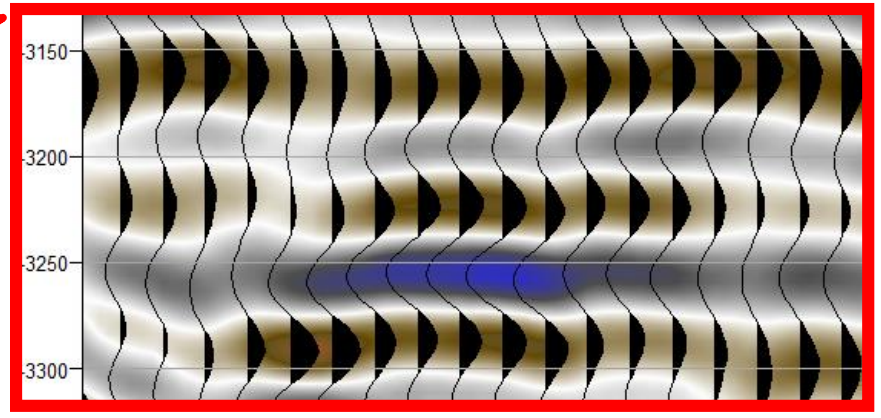
Approximately three (3)



Shallow Velocity = 2500 m/sec
Deep Velocity = 5000 m/sec

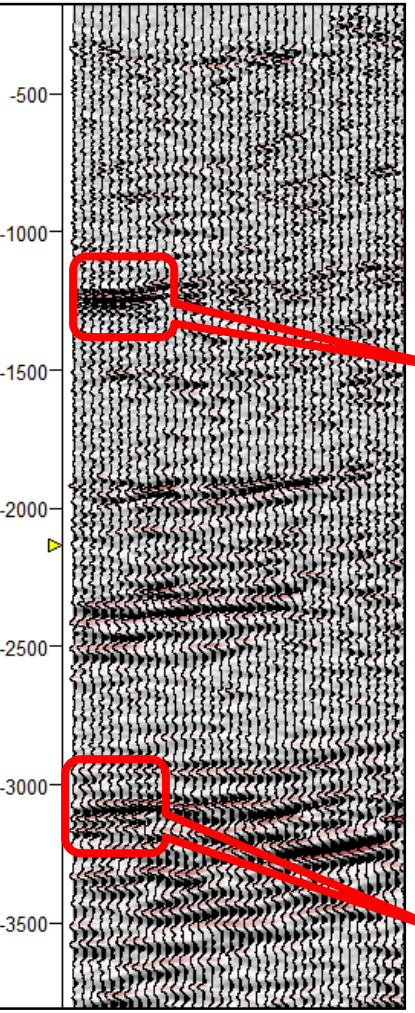
How many red-blue cycles are inside the red box from -3150 to -3300 ms?

Approximately three (3)

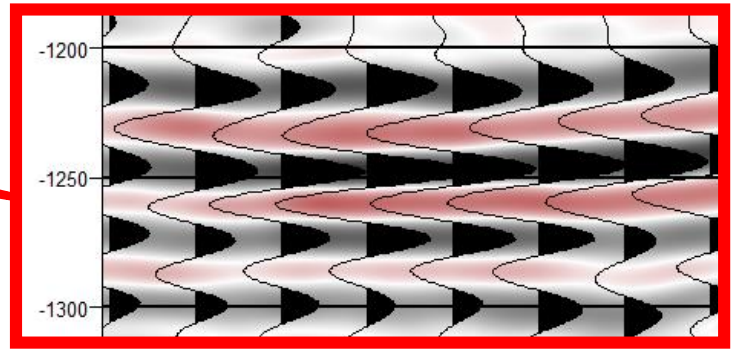


	Shallow Window	Deep Window
Frequency	$F_{apparent}$ = 3/0.1 = 30 HZ $F_{dominant}$ = (2 X 30) / 3.14 = 19 HZ	$F_{apparent}$ = 3/0.15 = 20 HZ $F_{dominant}$ = (2 X 20) / 3.14 = 12.7 HZ
Wavelength	λ = 2500 / 19 = 131.6 m	λ = 5000 / 12.7 = 393.7 m
Vertical resolution	λ /4 = 32.8 m	λ /4 = 98.4
Horizontal resolution	$=2500\ (0.375\ /19)^{0.5}$ = 351m	$=5000\ (1.65\ /12.7)^{0.5}$ = 1802 m

Calculating Frequency and Wavelength



How many black-white cycles are inside the red box from -1200 to -1280 ms?
Approximately three (3)



Shallow Velocity = 2000 m/sec
Deep Velocity = 4000 m/sec

How many black-white cycles are inside the red box from -3075 to -3200 ms?
Approximately three (3)