

1(a) See notes. Higher frequency reduces the wavelength but also increases attenuation.

(b) Shear waves

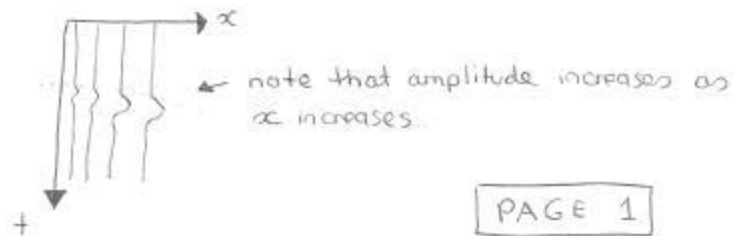
- never a first arrival
- require 3-component geophones
- don't travel in water

Advantages

- not attenuated by gas clouds
- some reservoirs have no P-wave anomaly, but do have an associated S-wave anomaly.

(c) AVO = amplitude versus offset

Reflection coefficients vary with the angle of incidence. This can give a measure of changes in P-wave and S-wave velocities associated with a reflection. Can be diagnostic of anomalous Poisson's ratio that would indicate a gas reservoir.



Q2

1: sphere $x_{1/2} = 105 \text{ m} \Rightarrow z = 137 \text{ m}$

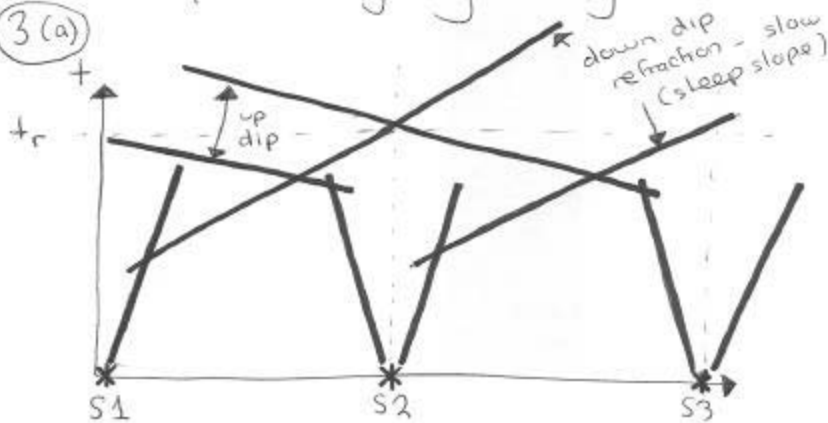
more dense than background

2: cylinder $x_{1/2} = 105 \text{ m} \Rightarrow z = 105 \text{ m}$

more dense than background

To distinguish, need grid of data and plot a map of the gravity anomaly

3(a)



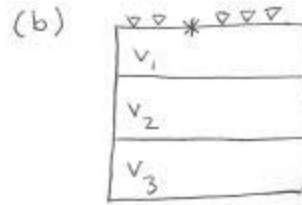
t_r = reciprocal time time $S1 \rightarrow S2$ must be the same as time $S2 \rightarrow S1$

3(b) Choose 2 from

- \Rightarrow low velocity zone not detected (no refraction)
- \Rightarrow this layer never gives a first arrival
- \Rightarrow geophone array too short to detect refraction as first arrival

Q4

(a) Label direct wave, ground roll, reflections



(c) $v_1 = 1750 \text{ m/s}$ $z_1 = 700 \text{ m}$ from 1st reflector

(d) Use direct wave $\Rightarrow v_1 = 1750 \text{ m/s}$

(e) $v_{\text{rms},2} = 2120 \text{ m/s}$

(f) $v_2 = 2500 \text{ m/s}$ $z_2 = 800 \text{ m}$

(g) $v_3 < v_2$ because the reflection has a negative polarity. Note that $v_2 > v_1$, and the first reflection was positive

Q5

(a) see notes

Diamagnetic: salt, feldspar

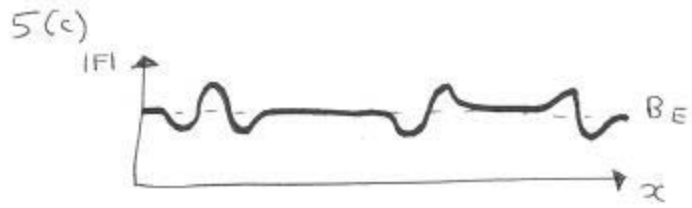
Paramagnetic: minerals with Fe or Ni

(b) REVERSALS 10,000 years \rightarrow million years

DAILY VARIATION Δ day

MAGNETIC STORMS hours \rightarrow days

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NORTH
POLE



EQUATOR