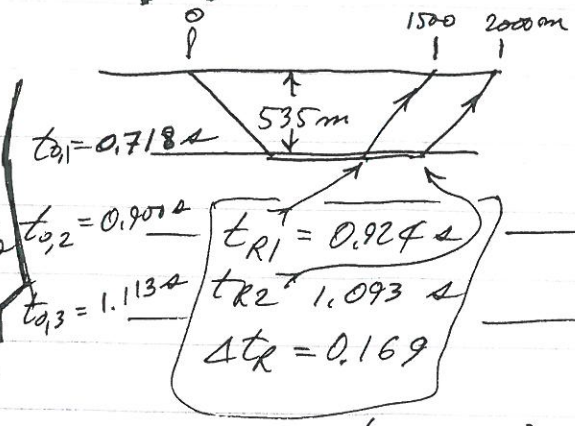
BPG 150 Exam 2013-11-28

1. α_1, vel. of seawater



3 (a) $\alpha_1 = \frac{2h_1}{t_{0,1}} = \frac{1070}{0.718} = 1490$ m/s (1490.25)

(b) Refractions ↗ $\alpha_2 = \frac{500}{0.169}$

3 $\alpha_2 = 2960$ m/s (2958.58)

(c) $V_{S,3} = 2300$ m/s $\quad \alpha_3 = \left[\frac{V_{S,3}^2 t_3 - V_{S,2}^2 t_2}{t_3 - t_2}\right]^{1/2}$

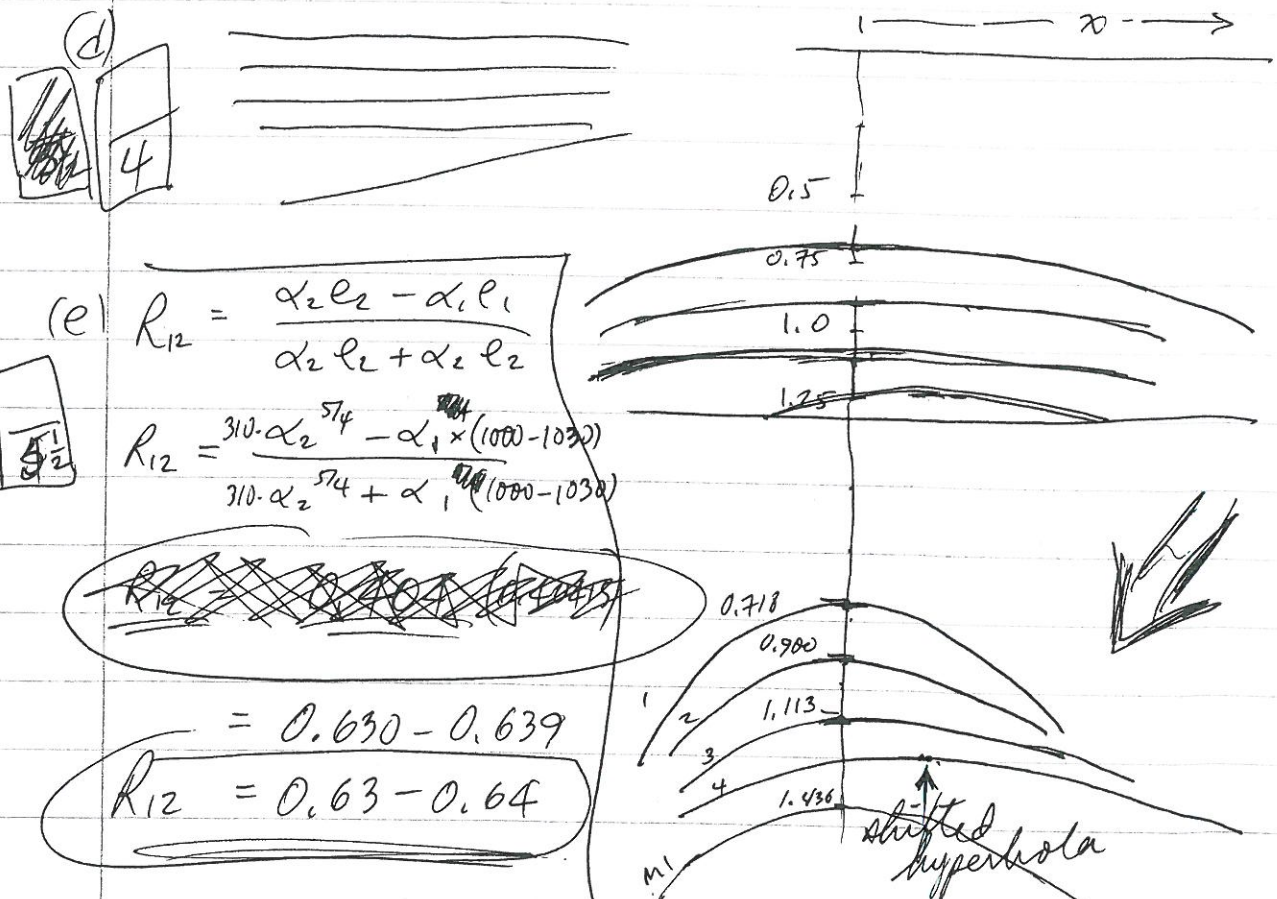
5½ let $V_{rms} = V_S$

We need to find $V_{S,2} = \left[\frac{\alpha_1^2 \hat{\tau}_1 + \alpha_2^2 \hat{\tau}_2}{\hat{\tau}_1 + \hat{\tau}_2}\right]^{1/2}$

$V_{S,2} =$ ~~1882~~ 1881.975+ m/s

$\alpha_3 =$ ~~17,444 m/s~~ 3560.43 ~~6650~~ m/s (~~6655.6~~) or 3560 m/s

(d)



(e) $R_{12} = \frac{\alpha_2 \ell_2 - \alpha_1 \ell_1}{\alpha_2 \ell_2 + \alpha_2 \ell_2}$

5½ $R_{12} = \frac{310 \cdot \alpha_2^{5/4} - \alpha_1^{5/4} \times (1000 - 1030)}{310 \cdot \alpha_2^{5/4} + \alpha_1^{5/4} (1000 - 1030)}$

~~$R_{12} = \frac{0.630 - 0.639}{0.630 - 0.639}$~~

$= 0.630 - 0.639$

$R_{12} = 0.63 - 0.64$

$$0.168^2 + 2150^{-2} x^2 = 0.302^2 + 2710.18^{-2} x^2$$

$$x^2 \left(\frac{1}{2150^2} - \frac{1}{2710.18^2} \right) = 0.302^2 - 0.168^2$$

17 (8) 4 | 2 3 / 1 2

16 (6) b) 3 4

(5) c 4

4+3

a) + ?

b)

?

a) 3

b) 2

c) 4

d) 3/12

Taking as α_3 2300 + finding new $V_{s,3}$

+ inst. of T in both

$$\rho_2 \simeq 310 \cdot \alpha_2^{1/4} = 2286.30 \text{ kg/m}^3$$

2958.58

$\rho_1 \simeq 1025 \text{ kg/m}^3$

$\rho_1 = \rho_2$ −3½

3½ for 0.404 (too much Gardner)

5½

4/5½ for our Gardner but west.

1. (f) $\frac{1}{\alpha_2} = \left[\frac{\phi}{\alpha_w} + \frac{1-\phi}{\alpha_M}\right]$ or $\frac{1-\phi}{\alpha_M} = \frac{1}{\alpha_2} - \frac{\phi}{\alpha_w}$

4

Then $\alpha_M = (1-\phi)\left[\frac{1}{\alpha_2} - \frac{\phi}{\alpha_w}\right]^{-1} = 0.8\left[\frac{-0.2}{1490.25} + \frac{1}{2958.58}\right]^{-}$

$\alpha_M = 3925.525$ or 3926 m/s

(1½/4) if α_2 & V_M interchanged

2. (a) 1. Drift — to correct for 'drift': change in instrument reading w. time at same place
2. Latitude — to correct for normal change of g with N-S displacement / latitude
3. Free-air — to correct for normal change of g w. elevation above MSL or ref. elev'n
4. Bouguer — to correct for effect of mass between ref. elev'n and reading elev'n
5. Eötvös — to correct for effect of moving instrument on ship or other moving platform
6. Terrain — for effect of very rugged terrain near obs. points

(7. Tidal — for Earth Tides (deform'n due to Moon's & Sun's gravity))

10

(b) At the poles (1½ * 3)

- least reduction of g from centripetal effect
- closest to centre of mass / of Earth

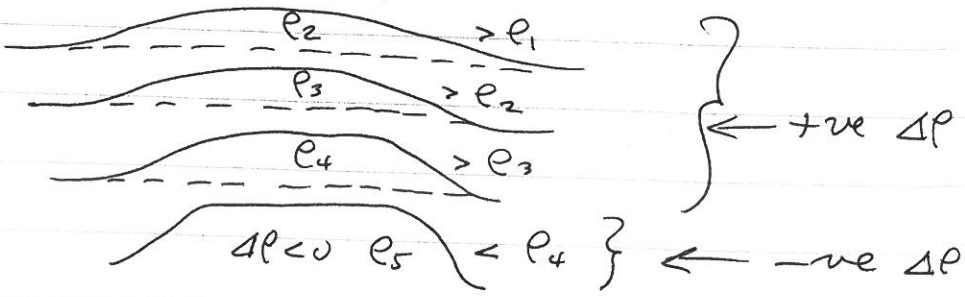
4½

3½

(c) 1. Diurnal correction – to correct for change in mag. field during day due to Sun
2. Geomagnetic – to correct for normal (average) variation of field over Earth

3

(d)

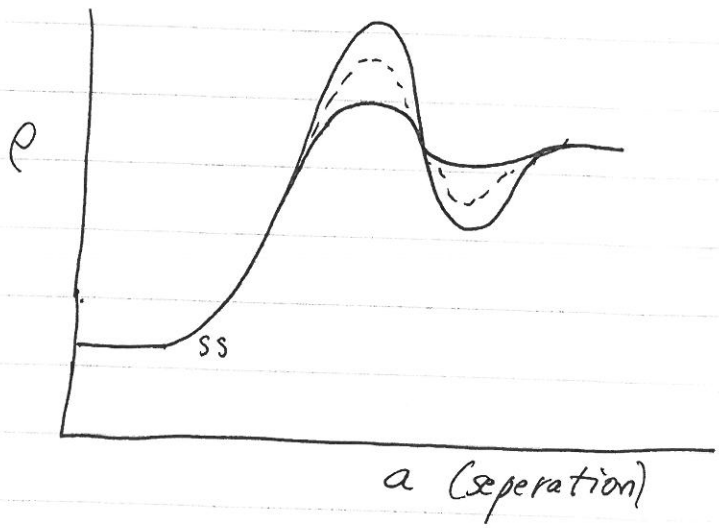


4

(e)

1 SS ϕ high, brine high salinity ⇒ v. low ρ
2 salt ⇒ v. high ρ
3 SH ϕ low, brine low salinity ⇒ low ρ
4 SS ϕ low, oil ⇒ high ρ

$\rho_2 > \rho_4 > \rho_3 > \rho_1$



3. Integrated

2½ (a) Salt dome

(b) (i) reflection – ~~seismic amplitude~~ or ground vel'y or

(ii) gravity: – accel'n or g

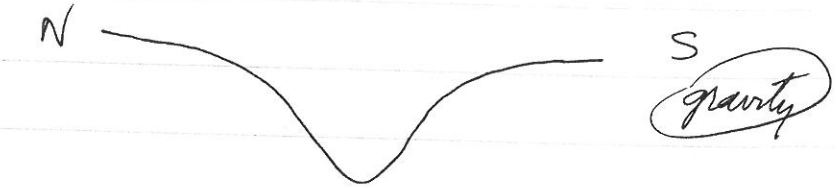
9½ ~~magnetic – field strength~~

~~(iii)~~ (iii) electrical – current density

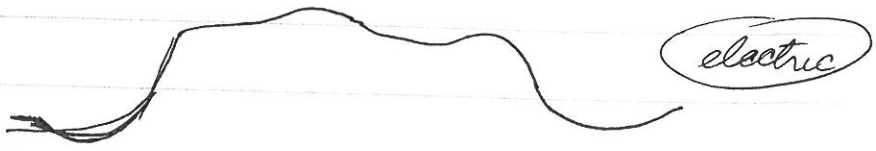
(iv) magnetic – field strength

(v) refraction/fan – ~~OR~~ arrival times

(c) (ii)

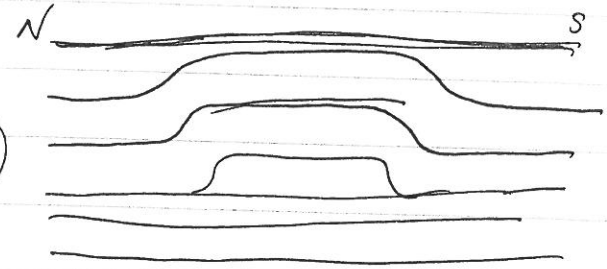


4½ (iii)

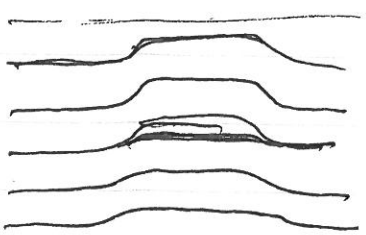


(iv)

(d) (i)



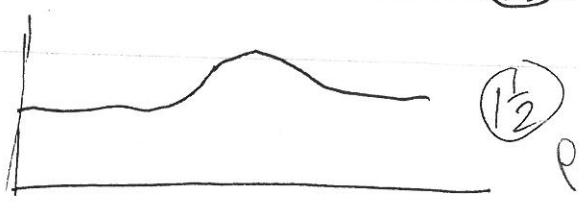
8½ (ii)



(iii)

(iv)

(v)



4 Fig. 1 (a) ~~Horizons~~ Events are not well resolved
not very continuous

(1/3)

(b) ~~Horizons~~ Events are well resolved, quite continuous
Traces & events well aligned

-1/4 for no statics
-1 for no "2-way time"
-1/4 for no "downgoing"
-1/2 for no "upgoing"
1 for VSP*

Fig. 2 (a) VSP Traces w. downgoing attenuated
(1/3) i.e. upgoing field (except maybe dashed line of 1st breaks)

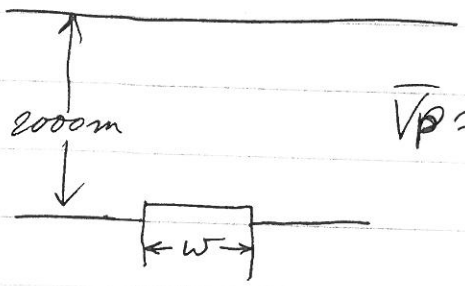
(b) 2-way time [adding down-time to upg
→ a sort of "NMO-correction"]

Fig. 3 (a) contains lot of ringing / reverbs (1)
(1/3) (b) ringing removed events can be seen (1/2)
Deconvolution (1/2)

Fig. 4 (a) Shot gather w. amplitude decreasing dras-
(1/3) tically w. depth/time (b) Amplitude boosted back
Correction for geometric spreading / spherical
divergence

Fig. 5. (a) Low-V noise obscures high-V reflections. (1)
(1/3) (b) Low-V " attenuated, reflections much more visible (1/2)
Vel'y Filtering -OR- spreading geophones for (b)
f-k (1/2) clustered in (a)

4. (b)



Take $w = w_F$, Fresnel-zone width

(5)

In this limiting case

$\lambda \doteq \frac{\tilde{V}_p}{f} = \frac{2500}{f}$ $\quad w = w_F = \sqrt{2\lambda z} = 300$ m $\quad z \doteq 2000$ m

So $\quad 300 = \sqrt{2 \times \frac{2500}{f} \times 2000}$

or $\quad f = \frac{2 \times 2500 \times 2000}{300^2} = 111.1$ Hz or ~ 110 Hz

So, to accomplish this resolution we need $f \geq 110$ Hz

(c)

(5)

To resolve we need $h \geq \frac{\lambda}{4}$. $\quad f \doteq 30$ Hz

$\lambda \doteq \frac{V_p}{f} = \frac{4250}{30}$ So $h \geq \frac{4250}{120}$ or $h \geq 35$ m

$\lambda = 141.67$ m

(Taking the $\frac{\lambda}{2}$ criterion, we can resolve $h \geq 20$ m)