

# Geology 5660/6660: Applied Geophysics

## Lecture 05 (Lab)

### Topics covered so far (& today):

*Ray Paths: Huygen's Principle (geometry), Fermat's Principle (calculus)*  
*1D Seismic Wave Equation (Derivation in Cartesian, Spherical coordinates)*  
*Wave Amplitude & Energy*

Four types of seismic waves:

*P* (“Primary” = sound; a *body wave*)

*S* (“Secondary” = shear; also a *body wave*)

*Surface waves* (Love & Rayleigh: at free surface only)

*Normal Modes* (“Resonant tones” = standing waves)

### Lab Today:

*Applications of Snell's Law*

Setting up spreadsheet calculations

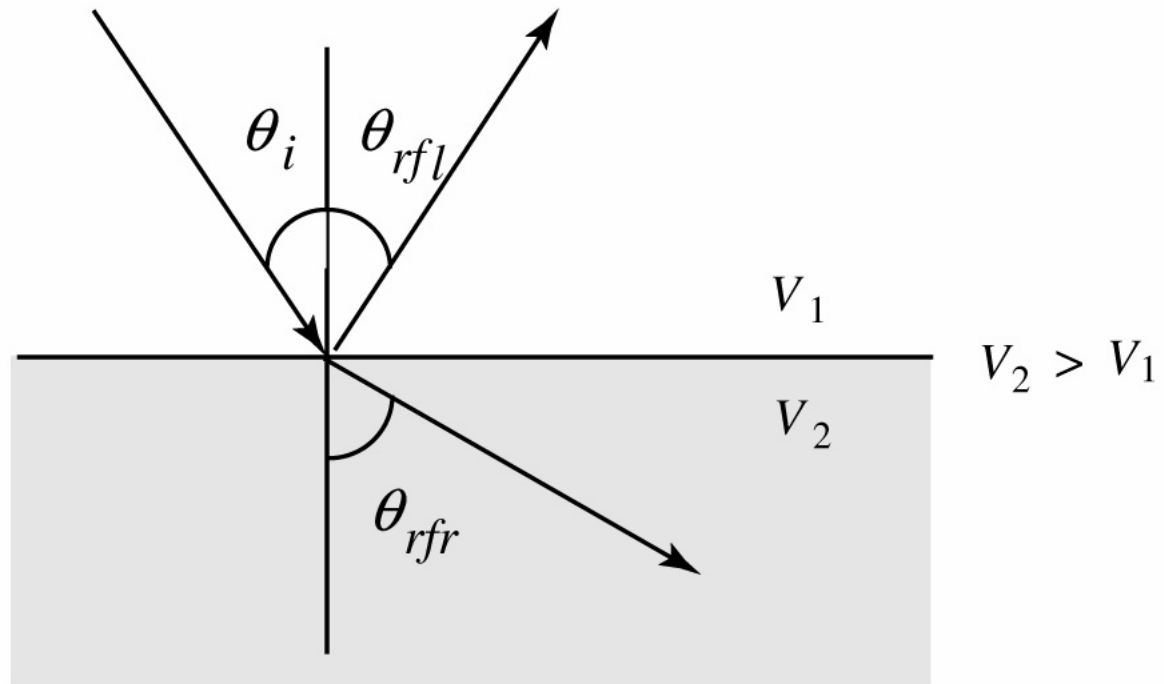
**Homework #1:** On course webpage by Wed, Jan 15<sup>th</sup>

**DUE:** Tue, Jan 28<sup>th</sup>, at the START of Lab

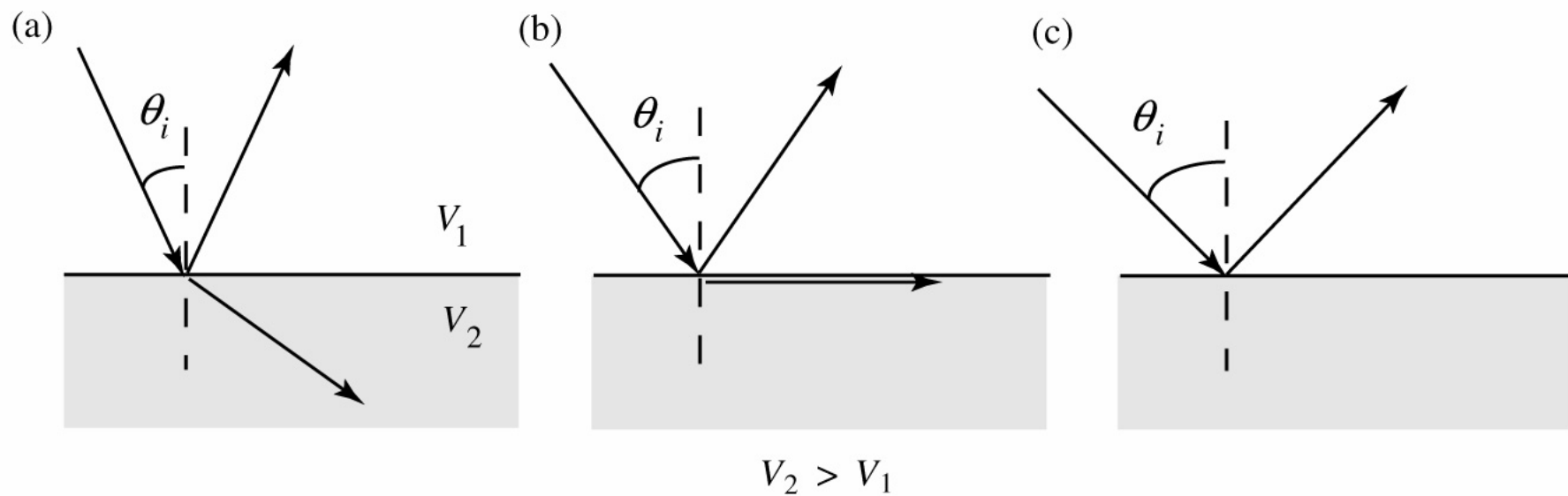
**Quiz # 1:** Topics discussed till today!

**DATE:** Tue, Jan 28<sup>th</sup>, FIRST HOUR of Lab

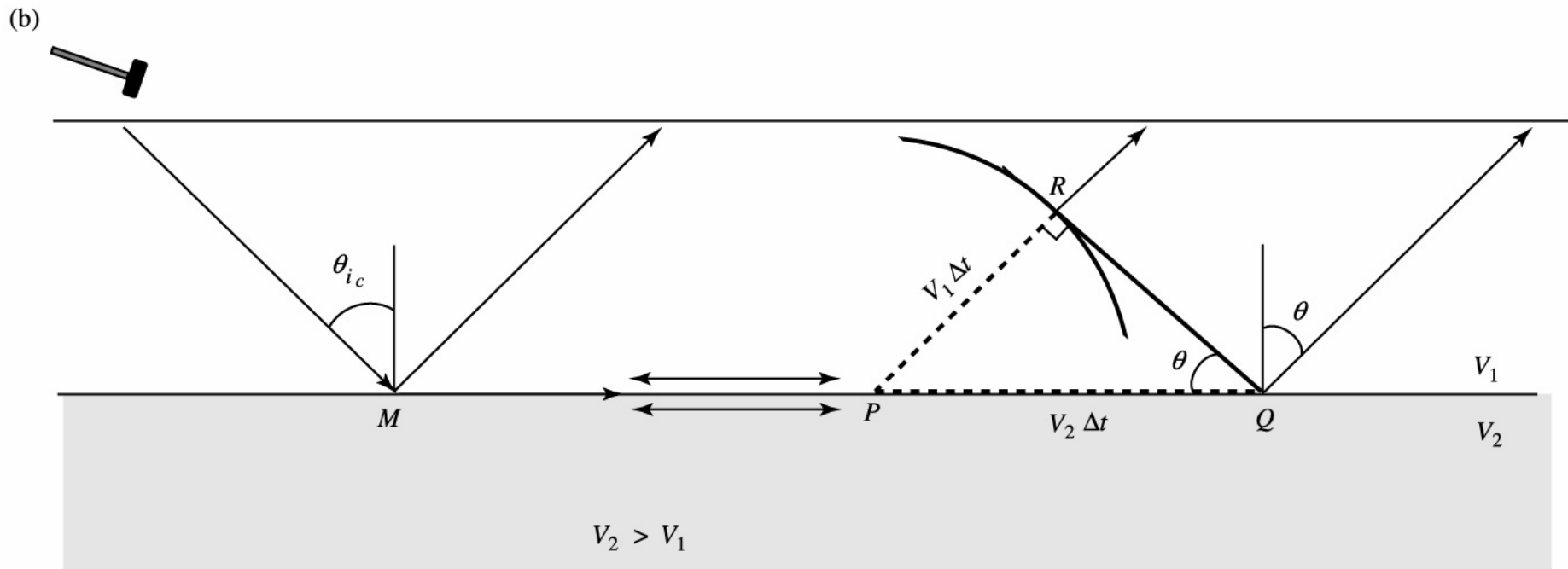
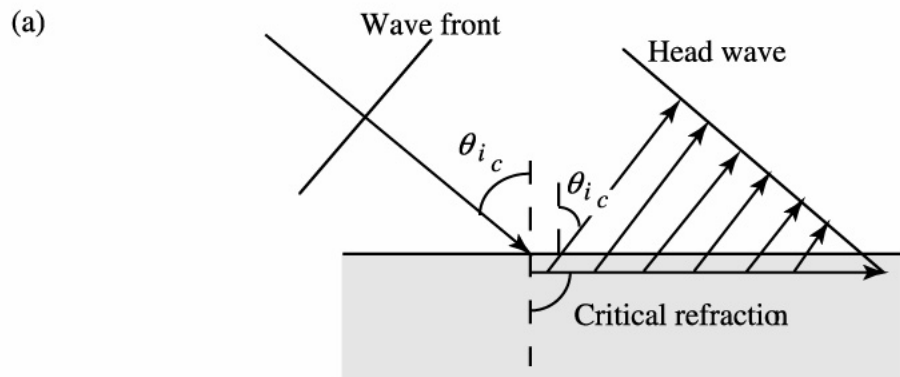
(a)



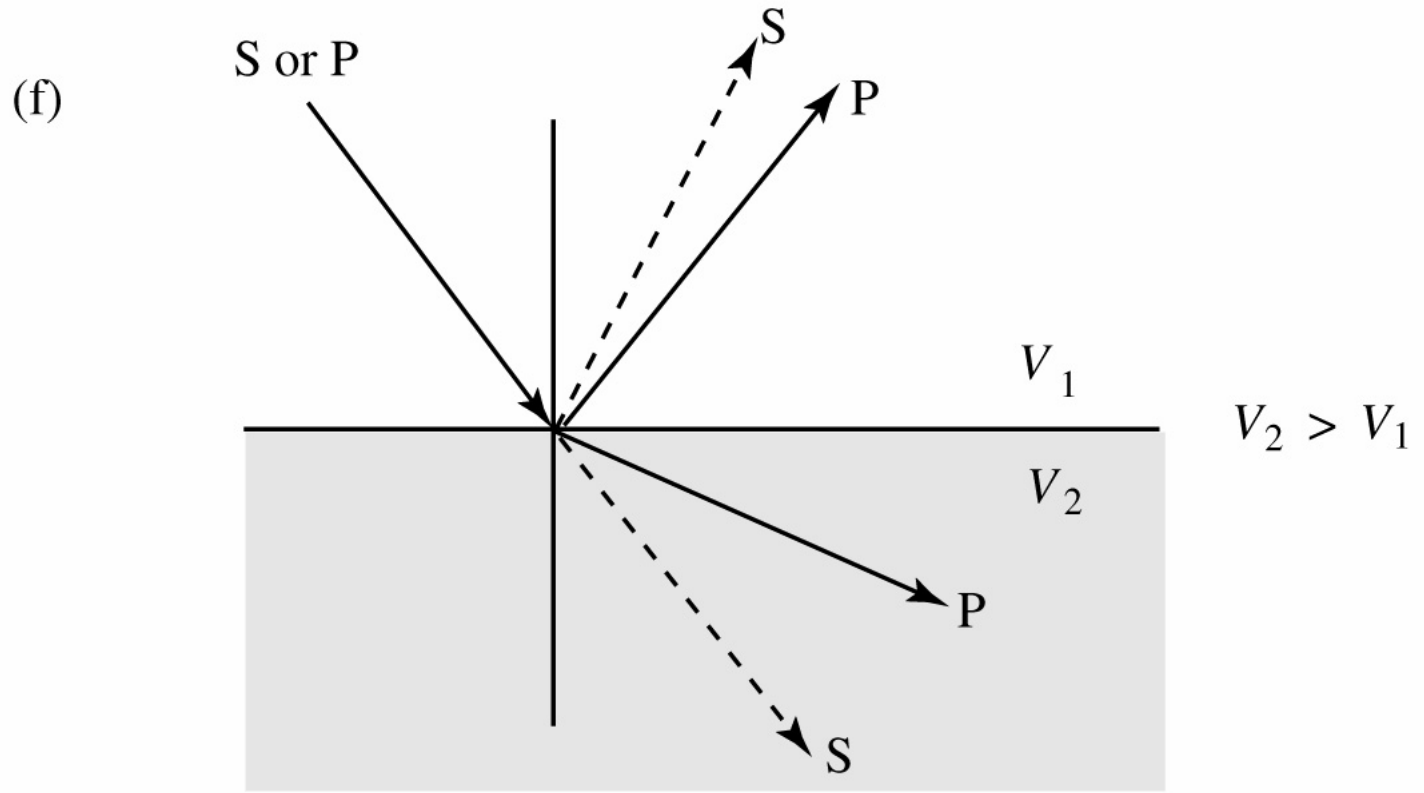
**FIGURE 2.15g A**



**FIGURE 2.17g**

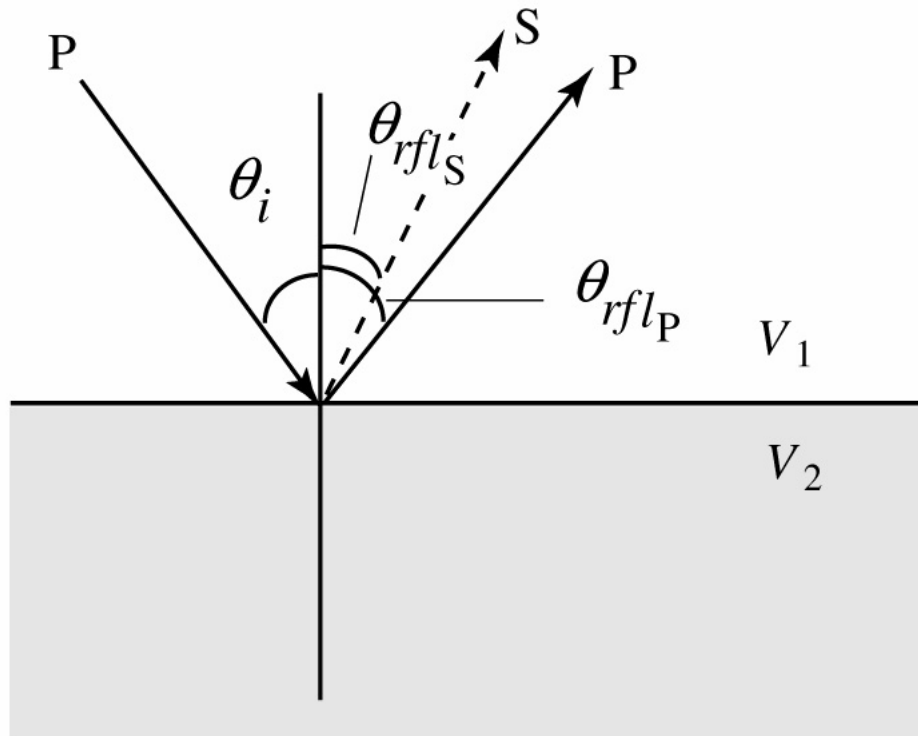


**FIGURE 2.16g**



**FIGURE 2.15g F**

(b)



$$V_{1P} = 1500 \text{ m/s}$$

$$\theta_i = 20^\circ$$

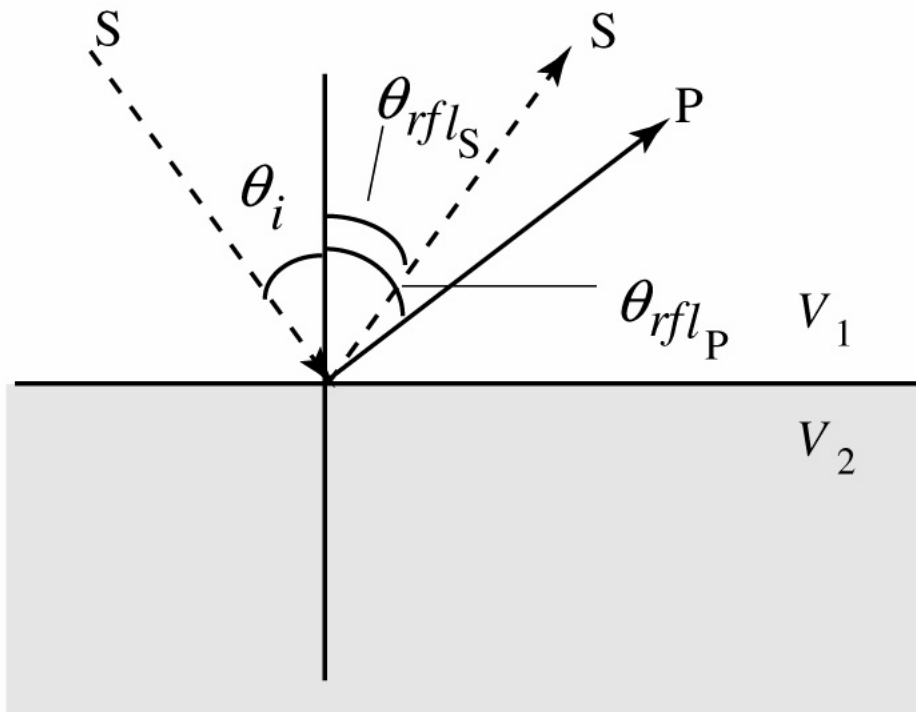
$$V_{1S} = 900 \text{ m/s}$$

$$\theta_{rfl_P} = 20^\circ$$

$$\theta_{rfl_S} = 12^\circ$$

**FIGURE 2.15g B**

(c)



$$V_{1P} = 1500 \text{ m/s}$$

$$\theta_i = 20^\circ$$

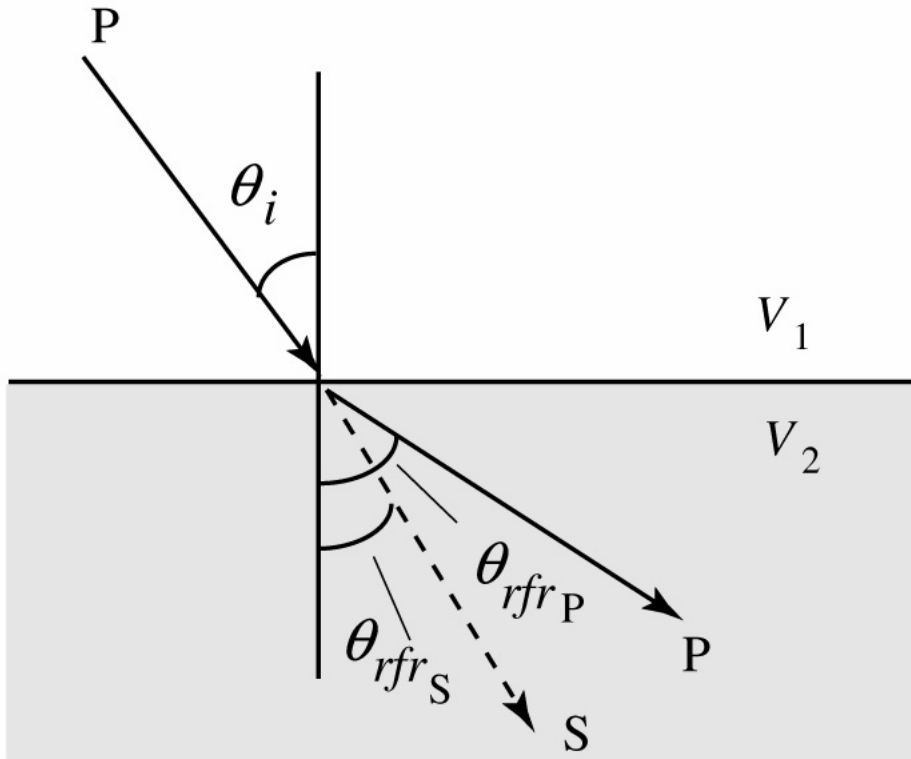
$$V_{1S} = 900 \text{ m/s}$$

$$\theta_{\text{refl}P} = 35^\circ$$

$$\theta_{\text{refl}S} = 20^\circ$$

**FIGURE 2.15g C**

(d)

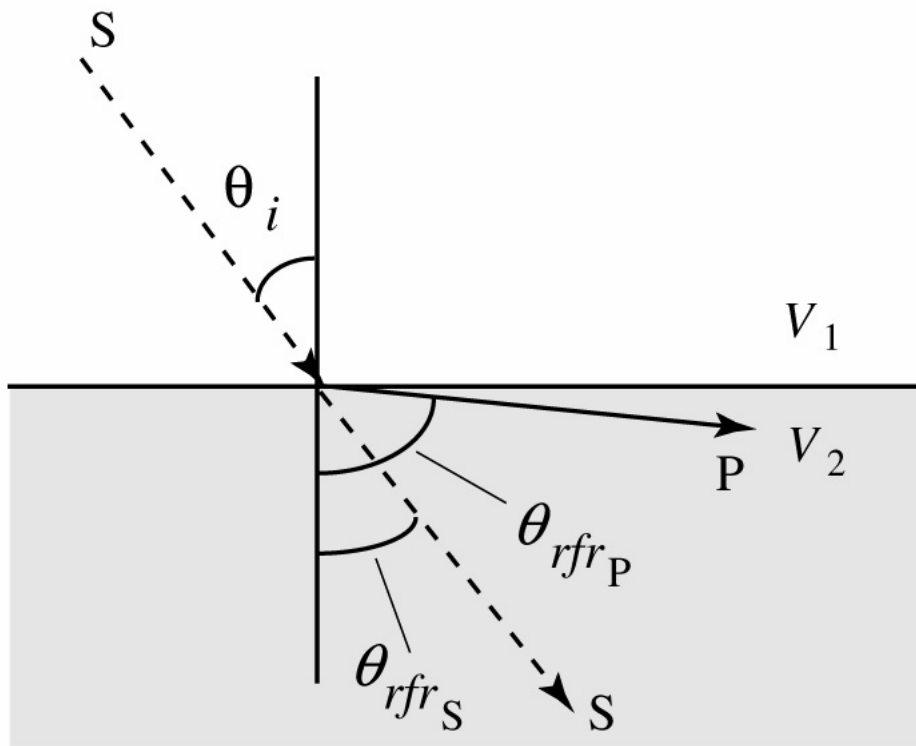


$$\begin{aligned} V_{1P} &= 1500 \text{ m/s} & \theta_i &= 20^\circ \\ V_{1S} &= 900 \text{ m/s} & \theta_{rfr_P} &= 66^\circ \\ V_{2P} &= 4000 \text{ m/s} & \theta_{rfr_S} &= 33^\circ \\ V_{2S} &= 2400 \text{ m/s} \end{aligned}$$

**FIGURE 2.15g D**



(e)



$$V_{1P} = 1500 \text{ m/s}$$

$$\theta_i = 13^\circ$$

$$V_{1S} = 900 \text{ m/s}$$

$$\theta_{rfr_P} = 88^\circ$$

$$V_{2P} = 4000 \text{ m/s}$$

$$\theta_{rfr_S} = 37^\circ$$

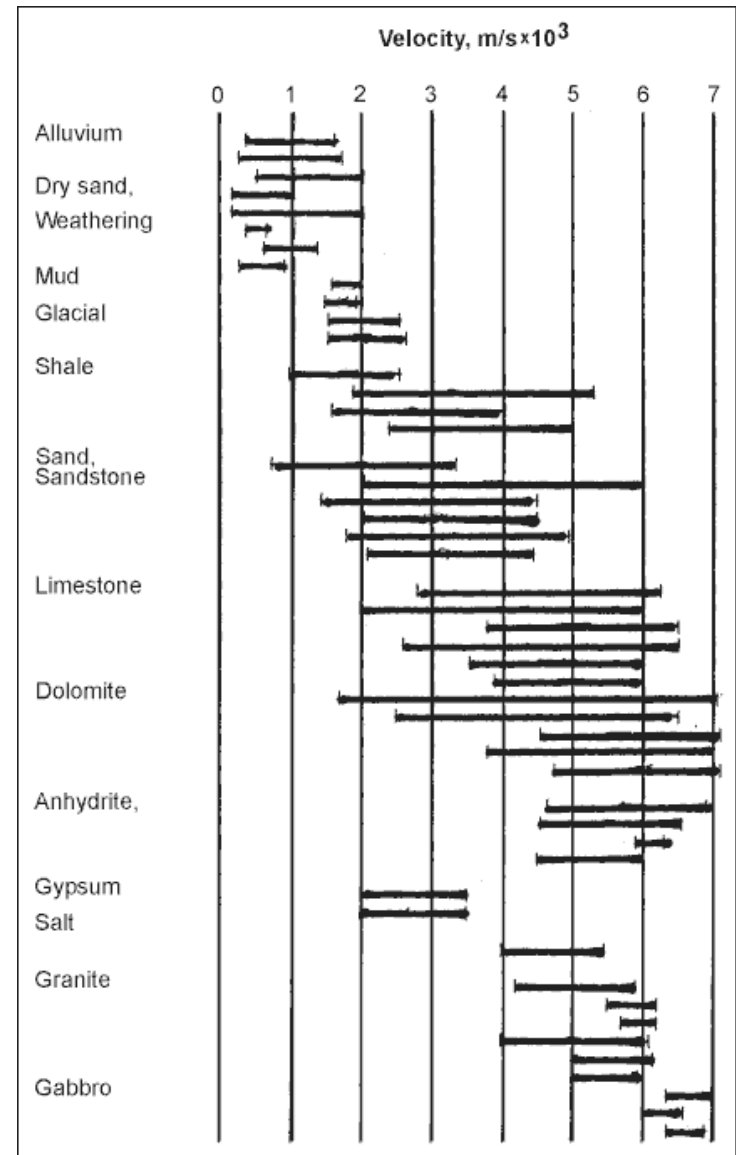
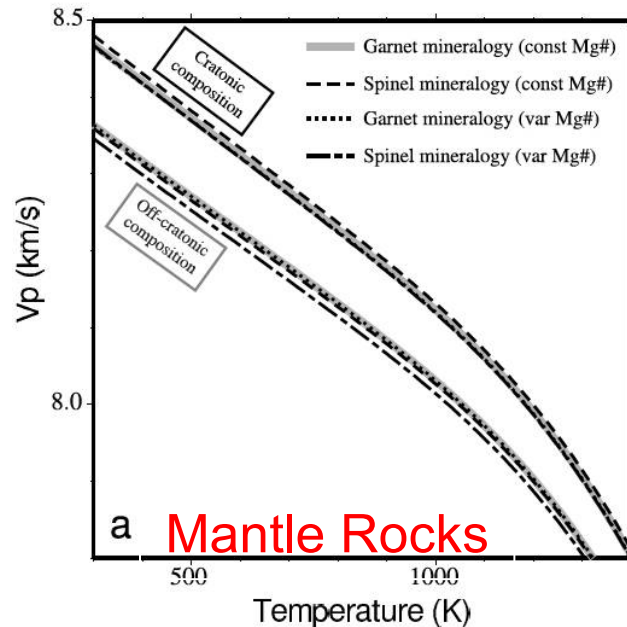
$$V_{2S} = 2400 \text{ m/s}$$

**FIGURE 2.15g E**

# Rock properties that affect $V_p$ , $V_s$ :

- Porosity
- Rock composition
- Pressure
- Temperature
- Fluid saturation

$V_p$ ,  $V_s$  : much more sensitive to  $\lambda$  &  $\mu$  than to  $\rho$



Crustal Rocks

Reading – by next week: **Burger** 29-60 (Ch 2.2.7–2.6)