9/12/23

ρ_b

$$\phi_{D,ss} = \frac{\rho_b - 2.65}{1 - 2.65}$$

$$\phi = \frac{\rho_b - \rho_m}{\rho_f - \rho_m}$$

step 1 Identify lith

↳ SS

step 2

$\phi_{N,SS}$

$\rho_b \rightarrow \phi_{D,SS}$

step 3

I → $\phi_{N,SS} = \phi_{D,SS}$ ⇝ water

$\phi = \phi_{N,SS} = \phi_{D,SS}$

II → $\phi_{N,SS} < \phi_{D,SS}$ ⇝ Fluids lighter than water

$$\phi = \sqrt{\frac{\phi_{N,SS}^2 + \phi_{D,SS}^2}{2}}$$

III → $\phi_{N,SS} > \phi_{D,SS}$ → Wrong Matrix

Example:

① $\phi_{N,ss} = \phi_{D,ss} \simeq 34\%$

② $\phi_{N,ss} = 4\%$

$\phi_{D,ss} = 56\%$ } → Fluids lighter than water

Method ①

$$\phi = \sqrt{\frac{4^2 + 56^2}{2}} = \underline{\underline{39\%}}$$

Method ②

$\phi_{D,ss} = 56\% \rightarrow \rho_b = ?$

$$\phi_{D,ss} = \frac{\rho_b - 2.65}{1 - 2.65} = 0.56$$

$$\rightarrow \rho_b = 1.726 \text{ g/cm}^3$$

$$\phi = \frac{\rho_b - \rho_m}{\rho_f - \rho_m} = \frac{1.726 - 2.65}{0.19 - 2.65} = \underline{\underline{0.37}}$$

Example: $\rho_f = ?$

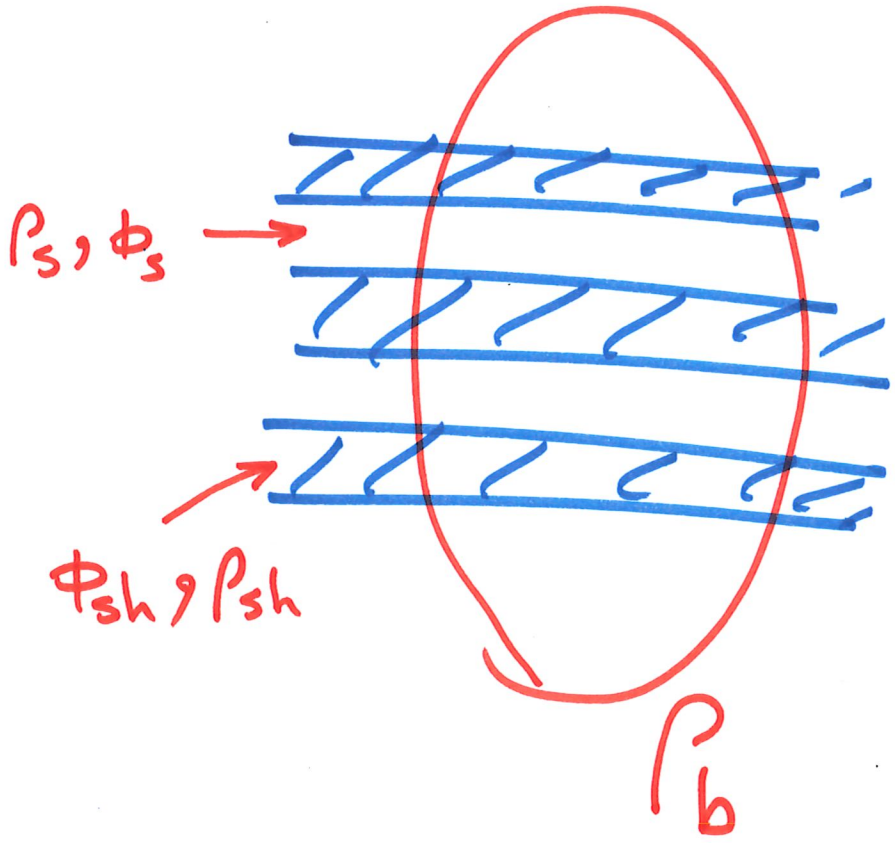
Depth 5550 ft:

ρ_b & ϕ_N $\rightsquigarrow$ $\phi = 39\%$

$$\phi = \frac{\rho_b - \rho_m}{\rho_f - \rho_m}$$

$$0.39 = \frac{1.726 - 2.65}{\rho_f - 2.65}$$

$$\Rightarrow \rho_f = 0.29 \ g/cm^3$$



$$\rho_b = \rho_{sh} C_{sh} + \rho_s (1 - C_{sh})$$

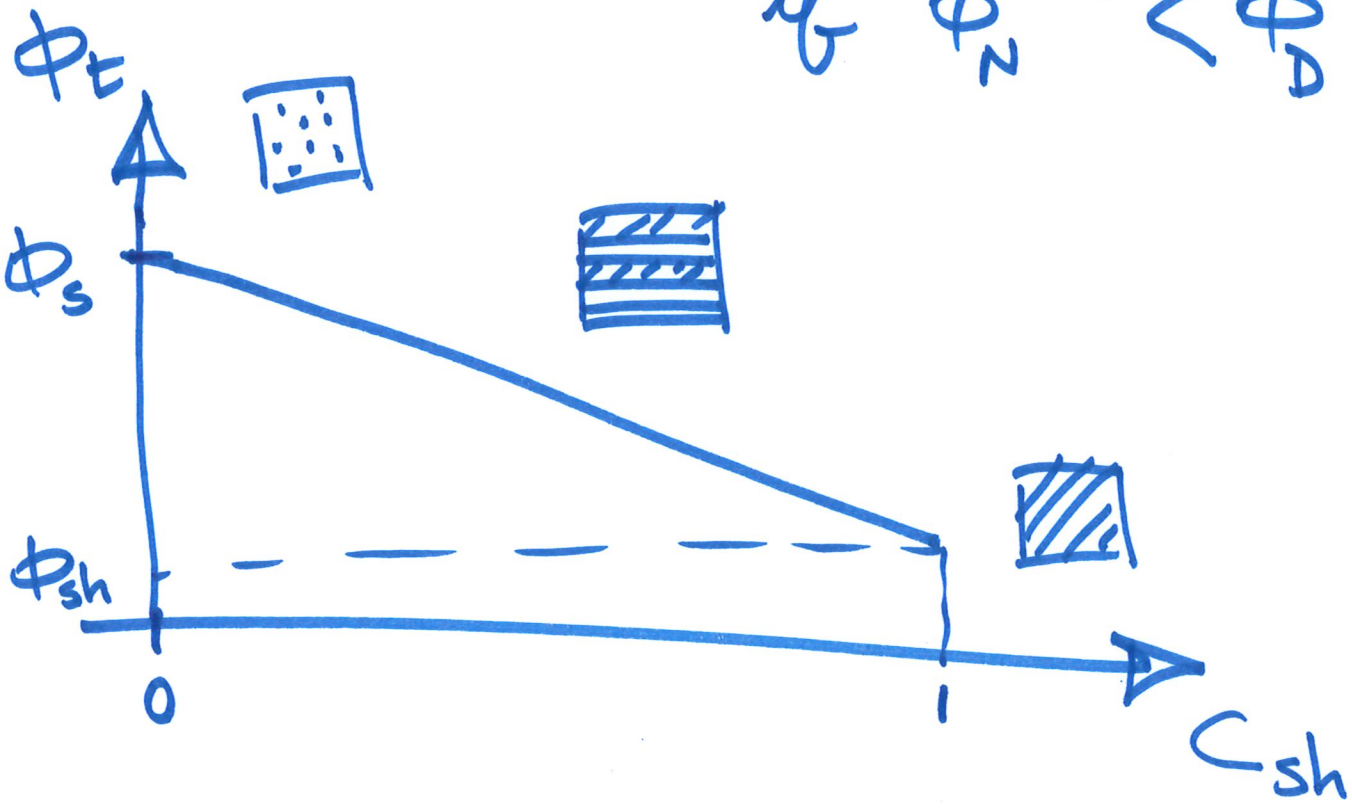
$$\rho_b = C_{sh} \rho_{sh} + \left[\rho_m (1 - \phi_s) + \phi_s \rho_f \right] (1 - C_{sh})$$

$$\phi_D^{(sh)} = \frac{\phi_D - C_{sh} (\phi_D)_{sh}}{1 - C_{sh}}$$

$$\phi_N^{(sh)} = \frac{\phi_N - C_{sh} (\phi_N)_{sh}}{1 - C_{sh}}$$

$$\phi_s = \sqrt{\frac{\phi_D^{(sh)^2} + \phi_N^{(sh)^2}}{2}}$$

if $\phi_N^{(sh)} < \phi_D^{(sh)}$



$$\phi_t = \phi_s (1 - C_{sh}) + C_{sh} \phi_{sh}$$

C_{sh} ?

GR

$$C_{sh} = \frac{GR - GR_s}{GR_{sh} - GR_s} = I_{sh}$$

$$C_{sh} = \frac{\phi_N - \phi_D}{(\phi_N)_{sh} - (\phi_D)_{sh}}$$

assumption : $S_w = 100\%$!

How to integrate ?