

HW-1: MACONDO EXERCISE (PSI)

In this exercise, we will plot the Macondo well pressures as 1) pressures, 2) overpressures, and 3) equivalent mudweights (e.g. Fig. 2.1).

- 1) Calculate Hydrostatic Pressure and Lithostatic Stress with Depth:
 - a. Fill out Table 2 based on Table 1 and Equations 1, 2, and 3.
- 2) Plot hydrostatic and lithostatic pressure on Figure 1 in terms of 1) Pressure, 2) Excess Pressure, and 3) Equivalent Mudweight.

Parameter	Value and Units
Hydrostatic gradient	$0.44 \frac{PSI}{ft}$
Overburden gradient	$1.0 \frac{PSI}{ft}$
Water Depth	5000 feet
Total Depth	20,000 feet
Reservoir Pressure	12,000 PSI
Reservoir Depth	18,000 feet

Table 1: Parameters for the exercise

To convert pressure (in psi) to equivalent mudweight (in ppg):

$$.052 * \text{Mudweight (PPG)} * \text{TVD}_{ss} (ft) = \text{Pressure (PSI)} \quad \text{Eq. 1}$$

$$\text{Mudweight (PPG)} = \frac{\text{Pressure (PSI)}}{.052 * \text{TVD}_{ss} (ft)} \quad \text{Eq. 2}$$

$$u^* = u - u_h \quad \text{Eq. 3}$$

Depth	Hydrostatic (u_h)		Lithostatic (σ_v)		Hydrostatic Effective Stress ($\sigma_v - u_h$)
	<i>PSI</i>	<i>PPG</i>	<i>PSI</i>	<i>PPG</i>	<i>PSI</i>
<i>feet</i>					
5000					
8000					
12000					
15000					
18000					
20000					

Table 2: Fill in the hydrostatic pressure and the lithostatic stress at the given depth points.

- 3) Plot the measured reservoir pressure as a point on the same graphs. Reservoir Excess pressure (u^*) is calculated from Eq. 3. The equivalent mudweight for the reservoir is calculated from Eq. 2.
- 4) Assume that the well is capped at the seafloor and the well bore is filled with oil of a static pressure gradient equal to 0.25 psi/ft. Plot the pressure from the reservoir to the seafloor assuming a static column of oil fills the wellbore.

$$\text{Oil Gradient} = 0.25 \frac{\text{PSI}}{\text{ft}}$$

Depth	Gas Reservoir Pressures (u_{oil})		Gas Overpressure (u^*_{oil}) ($u_{oil} - u_h$)
	<i>PSI</i>	<i>PPG</i>	<i>PSI</i>
<i>feet</i>			
5000			
8000			
12000			
15000			
18000			

SPREAD SHEET EXERCISES

- 1) Estimate the pore pressure at the seafloor if the borehole is filled with water, oil, or gas.
 - a. Water =
 - b. Oil =
 - c. Gas =

- 2) Extra Credit: When the well was capped, the actual pressure was 6600 PSI at the well head and the hole was filled with oil (0.25 psi/ft gradient). Estimate the in-situ pressure when the well was first capped. Why do you think this pressure is different from the measured in-situ pressure when the well was drilled (i.e. 12,000 psi)?

