HW-1: Macondo Exercise (PSI) ANSWERS

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:
	1. 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):

$.052\*Mudweight (PPG)\*TVDss \left(ft\right)=Pressure(PSI)$ Eq. 1

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

$u^{\*}=u-u\_{h}$ Eq. 3

|  |  |  |  |
| --- | --- | --- | --- |
| Depth | Hydrostatic (uh) | Lithostatic (σv) | Hydrostatic Effective Stress(σv - uh) |
| *feet* | *PSI* | *PPG* | *PSI* | *PPG* | *PSI* |
| 5000 | 2200 | 8.5 | 2200 | 8.5 | 0 |
| 8000 | 3520 | 8.5 | 5200 | 12.5 | 1680 |
| 12000 | 5280 | 8.5 | 9200 | 14.7 | 3920 |
| 15000 | 6600 | 8.5 | 12200 | 15.6 | 5600 |
| 18000 | 7920 | 8.5 | 15200 | 16.2 | 7280 |
| 20000 | 8800 | 8.5 | 17200 | 16.5 | 8400 |

1. 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.**1**

$$ Reservoir Presssure (u\_{oil})=12,000 PSI$$

$$Reservoir Depth=18,000 feet$$

$$u\_{h}=ρ\_{w}gz$$

$u\_{h}\left(z=18,000 ft\right)=0.44\frac{psi}{ft}\*18,000 ft$=7920 PSI.

Reservoir overpressure $(u^{\*})$: **0**

$u^{\*}=u-u\_{h}$ **80 PSI**

$$u^{\*}=12,000-7920=4,080 PSI$$

Calculate the Equivalent Mud Weight for of the reservoir pressure (Eq. 2)= **1**

Reservoir Pressure in Mud Weight (PPG)

$$\frac{12,000 PSI}{(.052\*18,000ft)}=12.8 PPG$$

1. Assume that the well is capped at the seafloor. Plot the pressure from the reservoir to the seafloor assuming a static column of oil fills the wellbore.

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

|  |  |  |
| --- | --- | --- |
| Depth | Oil Pressure inside casing  | **Overpressure (u\*oil)** |
| (uoil) | (uoil - uh) |
| *feet* | *PSI* | *PPG* | *PSI* |
| 5000 | 8,750 | 33.7 | 6550 |
| 8000 | 9,500 | 22.8 | 5980 |
| 12000 | 10,500 | 16.8 | 5220 |
| 15000 | 11,250 | 14.4 | 4650 |
| 18000 | 12,000 | 12.8 | 4080 |



