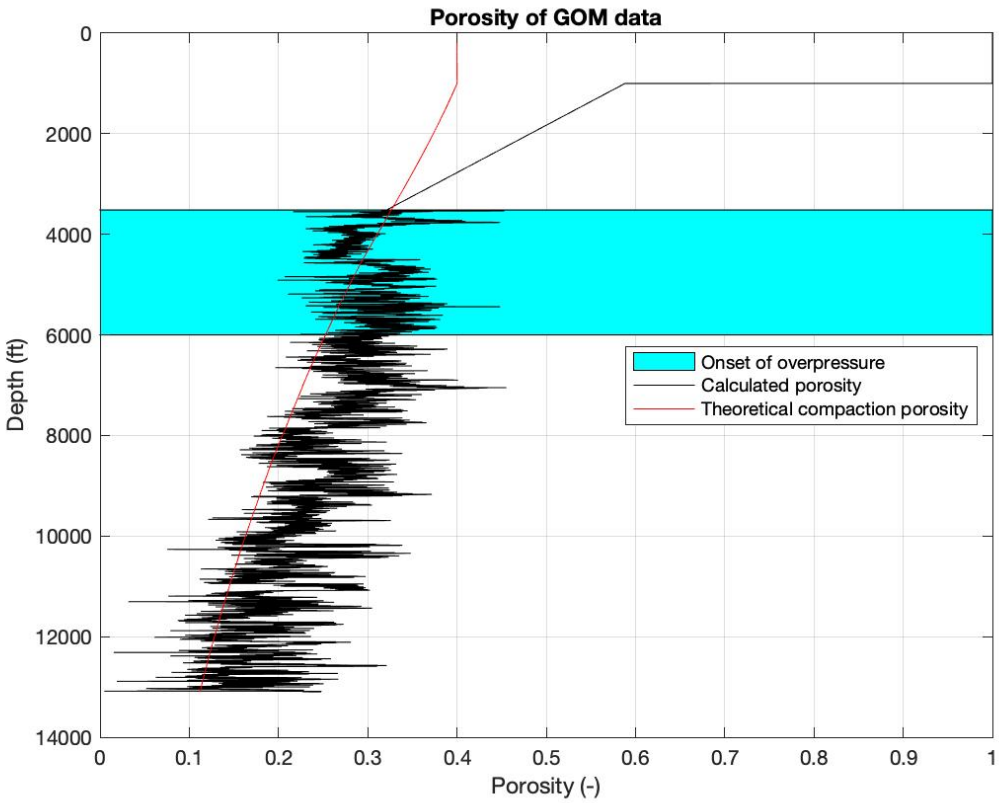
I. Estimate the depths of Gulf of Mexico overpressure

a. Plot porosity versus depth.

b. Use the parameters given to calculate a theoretical compaction trend.

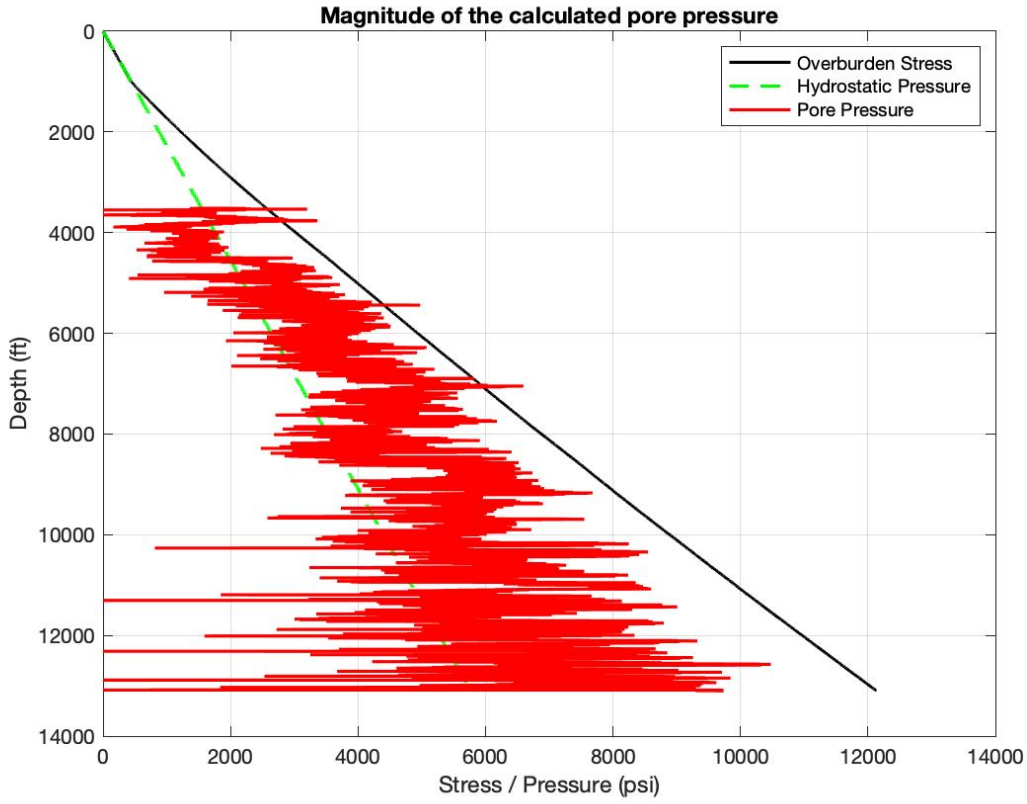
c. Estimate the onset of overpressure.



II. Estimate the magnitude of Gulf of Mexico overpressure

a. Compute pore pressure using the calculated porosity data.

b. Estimate the magnitude of overpressure.



III. Answer questions

Question 1:

>>a. Which of the following is a mechanism of overpressure generation in geologic reservoirs?<<

( ) Hydrocarbon maturation
( ) Mineral diagenesis
( ) Tectonic compression
(x) All of the above are possible mechanisms of overpressure generation.

[explanation]
All of the above are possible mechanisms of overpressure generation. Hydrocarbon generation from thermal maturation of organic matter in source rocks creates volumetric increases in pore fluids, and can thus lead to overpressure in geologic compartments or low permeability reservoirs. Mineral diagensis is often associated with dehydration reactions, which can lead to overall volume increases of both the pore fluid and the rock matrix itself, particularly in the case of clay minerals. Tectonic compression can create overpressure by increasing the rate of compaction relative to the rate that fluids can flow out of geologic reservoirs. See Lecture 3, Slide 19 for details.
[explanation]

>>b. Overpressure generation by disequilibrium compaction is most likely to occur in which case?<<

( ) The rate of fluid flow exceeds the rate of compaction and porosity loss
(x) The rate of compaction and porosity loss exceeds the rate of fluid flow
( ) The rate of fluid flow is equal to the rate of compaction and porosity loss

[explanation]
The rate of compaction and porosity loss exceeds the rate of fluid flow. See Lecture 3, Slide 19 for details.
[explanation]

>>c.Hydrocarbon column heights can result in substantial overpressure at the top of reservoir compartments especially when appreciable amounts of buoyant gas are present<<

(x) True
( ) False

[explanation]
Gas expansion at the top of reservoir columns can be a significant mechanism for overpressure generation
[explanation]

>>d. Pressure reversals (that is, pore pressure decreases with increasing depth) can result from:<<

( ) Drilling into a formation that was subjected to high tectonic compression
( ) Drilling into a formation that was produced by fast sedimentation
(x) Drilling into a less hydrologically isolated reservoir (that is, a reservoir that is more drained during consolidation than the formations above)

[explanation]
Pressure dissipation rates are higher in reservoirs that are more permeable and less hydrologically isolated causing them to be less subject to overpressure than less permeable and/or hydrologically isolated reservoirs.
[explanation]

Question 2: Estimating a pore pressure

a. What is the pore pressure at 6,000 ft? Enter your answer in psi without units.
   3195.6 +- 1278.2

b. What is the pore pressure at 10,000 ft? Enter your answer in psi without units.
   5363.0 +- 2145.2

Question 3: Estimating a pore pressure gradient

a. What is the pore pressure gradient at 6,000 ft? Round your answers to two decimal places. Enter your answer in psi/ft without units.
   0.533 +- 0.213

b. What is the pore pressure gradient at 10,000 ft? Round your answers to two decimal places. Enter your answer in psi/ft without units.
   0.536 +- 0.214

c. >> The smaller the “mud window” the harder it is to manage drilling parameters such as mud weight.<<

   (x) True
   ( ) False

   [explanation]
   It will be harder to utilize a mud weight that is larger than pore pressure (so the well would not flow while drilling) yet smaller than Shmin (to avoid frac’ing the well).
   [explanation]

Question 4: Estimating the onset of overpressure

Comparing the predicted and calculated porosities to estimate the depth of the onset of overpressure in the GOM data set. Enter you answer in feet without units.
4758 +- 1242

Question 5: Estimating the magnitude of overpressure

A magnitude of the overpressure is the difference between the calculated pore pressure and the hydrostatic pore pressure. Estimate the magnitude of the overpressure at 9,000 ft in the Gulf Of Mexico data set. Enter you answer in psi without units.
847.6 +- 839.1