Homework 2 – Estimating the Onset of Overpressure
Due 25 April 2017, 07:30 UTC

Please direct any questions to the Piazza discussion forum on the course website

Note that the deadline is in Coordinated Universal Time (UTC). If you want to see the current time in UTC, please google: "Current time in UTC."

Background

In this assignment, you will be estimating the onset of overpressure from the porosity values, ϕ, you calculated in Homework 1 for the Gulf of Mexico (GOM) dataset.

Utilize a scientific computing or plotting program such as Microsoft Excel or MATLAB to follow the steps below. Then, **answer the questions on the page below.**

Instructions

Part 1: Estimating the onset of overpressure

   a. *Plot porosity vs. depth* as you did in Homework 1. It is conventional to put depth on an inverted *y*-axis and porosity on the *x*-axis.

   b. *Now calculate theoretical porosity assuming an exponential compaction trend.* Assume exponential porosity reduction with effective stress of the form below:

   $\phi = \phi_0\,e^{-\beta\sigma}$

   where ϕ is the porosity, ϕ_0 is the initial porosity, β is the coefficient of compaction, and σ is the effective vertical stress (=Vertical stress from homework 1, minus hydrostatic pore pressure). Use values of $\phi_0 = 0.4$ and $\beta = 0.03$ MPa^{-1} or 0.0002 PSI^{-1}. Calculate the theoretical porosity for the full depth range of the GOM data set. Plot this trend on the same plot as the porosity data.

   c. *Estimate the onset of overpressure.* By comparing the theoretical and calculated porosities, estimate the depth at which the onset of overpressure first causes a deviation from the theoretical compaction trend. See Lecture 3, Slide 29 to guide your analysis.

Part 2: Estimating the magnitude of overpressure

a. *Compute pore pressure using the calculated porosity data*. Rearrange the equation in Part 1b to obtain an expression for pore pressure as a function of porosity. Calculate pore pressure using the calculated porosity data. Plot this calculated pore pressure as well as hydrostatic pore pressure as functions of depth on the same plot over the logged interval (3,515 to 13,100 ft).

b. *Estimate the magnitude of overpressure*. By subtracting hydrostatic pore pressure from the computed pore pressure using porosity data, estimate the magnitude of overpressure in the GOM data set.

Part 3: Answer the questions on the page below
Use the plots and calculations from Parts 1 and 2 to answer the questions on the page below. The answers will be posted shortly after the due date. Numerical entry type responses have only a range of acceptable values and are graded electronically, so please adhere to the values and units of constants given here to prevent misgrading of your submissions.