Lab 6 – Investigating eolian reservoirs in the Utah-Wyoming thrust belt.
Geological Data Analysis – Spring 2019
Due: March 7, 2019
40 points

1 Project overview

This lab is a two week group project. You will be working in groups of 2-3 using the python and data analysis skills learned so far in class to create a report about eolian reservoirs in the Utah-Wyoming thrust belt. The goal of your investigation is to characterize the field site and determine preferential zones or facies for resource extraction (either petroleum or water).

The report should be around 5 pages, including figures, and should address the questions posed in Section 2. It should include the following sections (**see included pdf for more details on scientific writing**):

- Introduction - describes the field site and goals of the study.

- Results - a summary of results determined from the data analysis.

- Discussion - a discussion of relationships and patterns found in the data, implications they might have for resource extraction. There should also be some discussion of any limitations of the dataset or uncertainties in conclusions.

- Conclusions - a summary of the conclusions/recommendations based on your study.

Note that, although it is discussed in the pdf on scientific writing, you do not have to include a methods section in this particular paper.

You will want to think about how to create visuals to aid your analysis and discussion. Tables are strongly discouraged as a data display format. Figures should include captions, labeled as Figure 1, Figure 2, etc., that explain what is displayed, including any use of linestyles, symbols, or colors to show features of the data. Captions may also include brief descriptions of any important relations or patterns that are evident in the figure. Refer to figure numbers in the text as you explain and discuss the data. In addition to the report, you should submit an ipython notebook that was used to generate your figures.

The data you will be using are from Lindquist (1988) (a pdf copy is included with this lab). The data are contained in Lindquist-1988.xls. This excel file contains some extra information in the "header" of the file so make sure to open it and read it.

2 Research questions

Overarching question: What locations, strata, or facies are the best targets for resource extraction based on measurements of porosity and permeability?

Question 1 (Data completeness): Are there sufficient measurements to characterize porosity and permeability of all the bedding types and stratigraphic zones?

Question 2 (Stratigraphic relationships): Do specific stratigraphic zones have higher or lower porosity and permeability?

Question 3 (Facies relationships): Do specific bedding types or depositional environments display higher or lower porosity and permeability?

Question 5 (Correlations): Are permeability and porosity correlated with each other? Do these correlations depend on facies?

3 Plots and analysis to consider

A part of this exercise is determining the best ways to graphically display your data to illustrate your main points. Therefore, you will want to think carefully about your selection of figures to accompany your text. Here are a few initial ideas to get you thinking about possible options and analyzing the data. In the end, you may not want to include all of these figures in your report, and you may want some additional ones that are not described here. For the report, focus on the figures that you find most helpful in interpretation.

- Plots of porosity and permeability vs. depth for each well, as can be found in Lindquist (1988). Display zone boundaries and try coloring the points by bedding type or depositional environment.

- Display histograms or boxplots of porosity/permeability for different zones, bedding, depositional environment. Calculate appropriate statistics. Since measurements within a single well are likely to be correlated, consider each well to provide a single "measurement" for porosity and permeability for each bedding type. Using the well mean values as your sample, estimate mean values for the population and the likely error of your estimate.

- Plot porosity vs. permeability. Could color by bedding type, zone, or depositional environment. Fit and display a linear regression. Fit regressions to individual groups.

Note: Be sure to use savefig() to export your figures into a format for bringing them into your report. Copy and paste from the notebook produces ugly, low-res results.

REFERENCES CITED

Lindquist, S. J., 1988. Practical characterization of eolian reservoirs for development: Nugget Sandstone, Utah—Wyoming thrust belt. Sedimentary Geology 56 (1), 315–339.