CARBONATE SEQUENCE STRATIGRAPHY

Introduction

This lab introduces you to carbonate sequence stratigraphy using knowledge from lecture, thin sections, hand samples, facies analysis, and facies correlations. You will identify systems tracts and reconstruct carbonate platform morphologies through time using sequence stratigraphic correlations.

Directions

1) You are given samples from 4 different facies (Facies A-D); there are several samples (hand samples and thin sections) for each facies. Look at samples in each facies and name each sample using Dunham's classification.

2) Using your observations and any additional information provided, interpret the probable depositional environment represented by each facies. Think about:
   - -abundance of fine grained matrix indicating depositional energy,
   - -abundance & diversity of fossils indicating a normal vs. "restricted" depositional setting (restricted refers to healthy vs unhealthy environmental conditions in terms of oxygen, nutrients, salinity)
   - -rock color (organic matter abundance indicating reducing or oxidizing conditions),
   - -sedimentary structures (or lack of structures) indicating bioturbation and oxygen levels
   - -bioturbation (or lack of bioturbation)

3) Briefly explain/list all data used to make your depositional interpretations.

4) Once you have interpreted the depositional environments, correlate Facies A-D between stratigraphic sections on the cross section using 'shazam lines' between columns.

5) At each stratigraphic column, outline with a vertical line, the transgressive systems tract (TST or transgressive interval and color it BLUE), maximum flooding zone (MFZ or deepest water and color it BROWN), and highstand systems tract (HST or regressive interval and color it RED). There may be more than one TST, MFZ, and HST.

6) Identify and outline the single, complete depositional sequence occurring within the cross section. Use this sequence to answer all subsequent questions.

7) On a separate piece of paper, draw the depositional profile (at the same horizontal scale given for cross section) of the carbonate platform during 3 different time intervals:
   a. Approximate middle of TST,
   b. Approximate middle of MFZ
   c. Approximate end of HST (sequence boundary)

   To do this, you must assign a reasonable water depth to each facies so that you can apply an appropriate vertical scale to the profile. For example, the shallowest water facies might represent 0-5 meter water depths, while the deepest wate r facies might represent 50-100 m water depths.

Facies A Thin sections VM-81, VW-75, 27 Hand samples Cmj	Facies C Thin sections C-1, C-2 Hand samples Kfs
Facies B Thin sections F, E-2, A-2, sponge-1, SA-2 Hand samples 1a, Olh	Facies D Thin sections B, peloid-2, A-1 Hand samples 3a displays small-scale cross beds & horizontal laminations

QUESTIONS

1) What is the main difference between your depositional interpretation of Facies C and Facies A? What do these differences indicate about the depositional environments?

2) Compare the gradient along the carbonate platform between the TST and HST. Was the gradient along the platform gentle or relatively steep? To answer this, use the water depths you assigned each facies to calculate an approximate gradient along your profile; your answer should be in meters/km; convert this value to degrees.

3) Was this a relatively high- or low-energy carbonate platform? To answer this question, think the abundance of grainstones and fine-grained matrix and their distribution across the transect, sedimentary structures, width of platform, and diversity of fossils.

4) Discuss which systems tract(s) is the most *isochronous* interval and which systems tract most useful for regional correlations. Include in your answer why the sequence boundary unconformities are poor for time control.