EART120: Sedimentology and Stratigraphy

Instructor and Contact Info: Matthew Clapham: mclapham@ucsc.edu, EMS A208, 459-1276.

Office Hours: Official times are Mondays from 11-noon or Tuesdays from 2-3. I have an open door policy, so you are welcome to drop by at other times if I am in my office, or you can schedule a meeting.

Class Meetings: MWF 1:20-2:25, EMS D236

Course Website: At Canvas (http://canvas.ucsc.edu). Handouts and assignments will be posted there and you will also need to log in to submit the field trip reports.

Course Learning Objectives

You will learn how to describe sedimentary rocks and interpret their depositional environment, with emphasis on problem solving in the field and the writing of geologic reports. The primary focus is on understanding the processes involved in the formation of sedimentary rocks, with the ultimate goal of interpreting ancient depositional environments from outcrop. You will place that information in the context of sequence stratigraphy, relating sedimentation to tectonic subsidence and sea level fluctuations.

At the end of the course, you should be able to:

1. Interpret ancient depositional environments by constructing and applying facies models
2. Relate sedimentary successions to changing sea level with sequence stratigraphy
3. Describe your results in reports and graphically with stratigraphic columns

Sed/strat, like many topics in the Earth sciences, involves making interpretations from data that are often incomplete or ambiguous. There sometimes isn't a "correct" answer. This class will help you develop an intuition for what is plausible or likely, helping you create working hypotheses to guide your observations and to fill in gaps where conclusive evidence may be lacking.

Rather than trying to memorize a list of idealized characteristics for each depositional environment, which isn't a great strategy because real outcrops are rarely idealized, you will learn how to use process sedimentology to predict the expected features in an environment given the expected environmental conditions present in that setting.

The first part of the course will focus mostly on the process side, and the second part will let you apply those techniques to the complex mosaic of environments in coastal depositional settings.

Class Structure and Assignments

We will use a flipped class structure with active work on exercises during class meetings, because research strongly supports its effectiveness.

Pre-class assignments: You will watch a short video (10-15 minutes long), primarily intended to introduce concepts and terminology. They provide a foundation for the hands-on exercises, so you should take good notes and try to understand the key concepts. I anticipate that you'll probably spend around 30-45 minutes. The videos are an efficient way of providing information, but that doesn't mean that they are your only source. I am happy to explain concepts in more detail, or in a different way, if the video isn't clear to you. Feel free to stop by my office to discuss it.

In-class work: You'll then spend class time working individually or in small groups on hands-on exercises. You will get the most out of these exercises if you are familiar with the information from the video and come prepared to use it to solve problems. The in-class assignments are designed to challenge you and give you experience working on real problems. Actively working through challenging problems is crucial for forming a linked network of strong connections in the brain that will help you build deep, lasting knowledge. You may feel at times like you're struggling, but that's actually a sign that you're learning. The TAs and I will be there to guide you through the in-class assignments, so make sure to ask questions frequently and ensure that you master the concepts and skills. The exercises are designed for teaching, not testing, so will be graded for completion only.

Final exam: The final exam will focus on stratigraphic columns, targeted to evaluate the class learning goals of interpreting depositional environments and relating them to sea-level changes. The exam is intended to test whether you can apply your knowledge to solve problems, not whether you can memorize facts. Because of that, you will be allowed to bring and use an information sheet.

Field Trips and Reports

The field exercises will provide you with experiences in applying concepts that are introduced in the lectures, within an observational and problem-solving format. All field trips will leave from the TAPS parking lot (lot 116 on this map: http://taps.ucsc.edu/pdf/parking-map.pdf) PROMPTLY at 8:30 AM and will return by 4:30 PM or before. Be prepared to spend a full day outdoors, regardless of the weather conditions. This means bringing sunscreen, rain gear, and layers of clothing (two of our sites are on the beach, which can be cold/foggy/windy even if weather on campus is warm), as well as water and food.

April 15	San Benito	Report and column due April 25
April 29	Pigeon Point	Report and column due May 16
May 20	Montara Beach	Report and column due June 6

Reports (including required figures and stratigraphic columns) are due by 5 PM on the due date. Written reports should be submitted as a digital file (Word or Open Office preferred, pdf accepted; not Pages format) to the assignment page at Canvas. Hand-drafted stratigraphic columns can be put in my mailbox in A234 or given to me in class or in my office. ALL reports and columns must be completed to pass EART 120 (if you miss a field trip you must complete the field assignment on your own).

All reports must be typed, double-spaced, and follow the specified format. Reports will be graded on the completeness of the report (includes clarity of writing, as well as grammar and spelling), presentation of observations, and geologic interpretations. Specific instructions will be provided for each assignment.

Textbook: All relevant material will be covered in the videos and exercises. If you want further background information or a book for future reference, there are two texts I recommend.

Sedimentary Environments: Processes, Facies and Stratigraphy, by Harold Reading. This book is an exceptional resource for its detailed discussion of sedimentary processes and facies models.

Principles of Sequence Stratigraphy, by Octavian Catuneanu. This is the best reference on sequence stratigraphy I have seen and it explains the topic in an extremely clear (and also detailed) fashion.

Grading Policies

In-class exercises:	10%
San Benito assignment:	10%
Pigeon Point assignment:	15%
Montara assignment:	30%
Final exam:	35%

Percent scores will be converted to letter grades using the following scale:

>90% = A+	>85% = A	>80% = A-
>76% = B+	>73% = B	>70% = B-
>65% = C+	>60% = C	>50% = D

Aside from correcting errors from counting of points or data entry, I do not regrade assignments or provide extra credit work. This policy ensures a level playing field for all students.

Late Policy

Reports: The due dates (all assignments due at 5 PM on the date) are chosen so that you can receive timely feedback to be applied to your next assignment. There should be sufficient time to complete the papers, especially if you minimize procrastination, but I recognize that deadlines and exams from other courses can occasionally all occur at the same time. Because of that, each due date has a two-day grace period; you can turn in the paper up to two days after the posted deadline with no questions asked. If you have circumstances that you feel prevent you from completing your best work even with the grace period, please meet with me before the original due date. I am happy to arrange an additional extension, as long as you are making progress and we can come up with a plan and timeline to help you succeed.

In-class work: Ideally, in-class exercises will be turned in at the end of class, so I can provide rapid feedback by the next meeting. However, if you feel like additional time would help you gain a better understanding of the concepts, you can turn in the exercise at the next class. Spacing out practice, rather than doing everything in a big chunk, is also important for learning. Therefore, each in-class exercise will receive full credit if turned in by the next class, and half credit if turned in at any point later in the quarter. I strongly encourage you to attend class to maximize your learning and to take advantage of guidance from the instructors and your fellow classmates. If you are unable to attend class, in case of illness, personal or family issues, workload in other courses, or any other situation, the exercises will be available online and I am happy to help during office hours or outside of class. If you anticipate missing multiple consecutive classes, please let me know so we can come up with a plan to make sure you are keeping up with the material.

Plagiarism and Academic Dishonesty

The scientific method builds upon previous results, but it is extremely important to rephrase ideas in your own words. Rewriting is important not only because it is ethical, but also because plagiarism hinders you from achieving a deeper understanding of concepts and prevents you from practicing important skills like writing. Because academic dishonesty circumvents the learning process, I have a zero-tolerance policy for plagiarism or other forms of cheating. For instances of plagiarism in written material, you will be asked to re-do the assignment and the incident may be referred to your college provost.

You are encouraged to work in groups during the labs, field exercises, and on in-class assignments so you can learn from each other, but your written answers must be original.

Disability Accommodations

UC Santa Cruz is committed to creating an academic environment that supports its diverse student body, and I am similarly committed to ensuring everyone can participate in this course. If you require accommodations to achieve equal access in this course, please stop by my office with your letter from the Disability Resource Center (DRC), preferably within the first two weeks of the quarter, so we can discuss ways to ensure your full participation. I encourage all students who may benefit from learning more about DRC services to contact DRC by phone at 831-459-2089 or by email at drc@ucsc.edu.

EART 120 – SEDIMENTOLOGY AND STRATIGRAPHY
Spring 2018 Class Schedule

Lecture slides, assignments, and other materials will be posted at the Canvas site

Some in-class exercises require use of a computer (*)

	Date	Main Topic	Video / Reading
Mon	Apr 2	Class goals; intro to sedimentology/stratigraphy	
Wed	Apr 4	Fluvial environments (*)	*1 – Fluvial type*
Fri	Apr 6	Fluvial sediment transport and bedforms (*)	*2 – Sediment transport* *3 – Unidirectional bedforms*
Mon	Apr 9	Sedimentary structures	*4 – Unidirectional sedimentary structures*
Wed	Apr 11	Fluvial facies models	*5 – Facies models*
Fri	Apr 13	Fluvial facies models (*)	
Sun	**Apr 15**	**San Benito Field Trip**	
Mon	Apr 16	Base level and accommodation	*6 – Fluvial sequence stratigraphy*
Wed	Apr 18	Alluvial processes and facies models (*)	*8 – Alluvial fans*
Fri	Apr 20	Subsidence and basins	*9 – Basin analysis*
Mon	Apr 23	Aeolian processes and facies models (*)	*10 – Aeolian environments*
Wed	Apr 25	Submarine fans	*11 – Submarine fan processes*
Fri	Apr 27	Submarine fans	*12 – Submarine fan systems*
Sun	**Apr 29**	**Pigeon Point Field Trip**	
Mon	Apr 30	Deep-water facies debate	*See assignment*
Wed	May 2	Provenance	*7 – Provenance*
Fri	May 4	Systems tracts and sequence stratigraphic surfaces	*14 – Systems tracts and shoreline shifts*
Mon	May 7	Wave-dominated coast processes, facies models (*)	*15 – Wave dominated coasts*
Wed	May 9	Tidal flat processes, facies models	*16 – Tidal flats*
Fri	May 11	Coastal facies practice (*)	
Mon	May 14	Delta processes, facies models (*)	*17 – Delta environments*
Wed	May 16	Estuary processes, facies models	*18 – Estuary environments*
Fri	May 18	Barrier island coast processes, facies models (*)	*19 – Barrier islands*
Sun	**May 20**	**Montara Beach Field Trip**	
Mon	May 21	Coastal facies practice	
Wed	May 23	Trace fossils and ichnofacies	*20 – Ichnofacies*
Fri	May 25	Coastal facies/sequence strat wrap-up	*21 – Parasequences/sequence boundary*
Mon	May 28	*No class – Memorial Day*	
Wed	May 30	Carbonate processes	*22 – Carbonate processes*
Fri	June 2	Carbonate ramp facies	*23 – Carbonate ramps*
Mon	June 4	Carbonate platform facies (*)	*24 – Carbonate platforms*
Wed	June 6	Reefs and microbial carbonates (*)	*25 – Reefs;27 – Microbial sediments*
Fri	June 8	Final review	
Mon	**June 11**	**FINAL EXAM (7:30-10:30 PM)**	