GSCI 355 (3 credits) **Fall 2021**

Basin Analysis

Instructor:
Dr. Jacalyn *Wittmer* Malinowski
Office Hours: Virtual (Zoom) and In-Person in ISC 19, Wednesdays 1-3pm
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Lecture: Tuesdays and Thursdays, 10:00am-11:15am
ISC Rm 19; Key Code: 1379

Course Description: Sedimentary basins are formed in a variety of geologic settings and need to be understood in terms of their tectonic context (compressive, extensional or strike-slip), sedimentary fill and sequence stratigraphy, climate controls on facies distribution and provenance, and thermal and geochemical evolution/alteration of the basin fill. In this course the student will gain an understanding of the dynamic processes that lead to basin formation, burial, and deformation. To read the basin fill as a record of tectonic and sedimentary events, it is necessary to understand how these processes create the sedimentary record in each basin. This course will cover these processes and their interactions, as understood from various observational data sets (sedimentary, structural, geochemical, and geophysical), as well as the quantitative forward and inverse models commonly used to extract or constrain basin history. The course will also analyze both the mechanics and play of petroleum and coal exploration of basins. This course is applicable to geology students from a variety of disciplines, including paleontology, geochemistry, stratigraphy, geomorphology, and tectonics, and is particularly beneficial to those students interested in petroleum geology. Prerequisite: GSCI 220.

Learning Outcomes

After successful completion of the course, a student will be able to

- Assess basin-wide evolution with respect to tectonics, by using databases and mathematical models
- Evaluate crustal dynamics using quantitative models in response to changes in basin formation and fill
- Develop confidence in data interpretation and evaluate the risk of using uncertain data
- Predict hydrocarbon occurrences based on stratigraphy, lithology, and structure
- Analyze and evaluate quantitative data to create confident projections for petroleum play locations and production

Recommended Texts (not required):

- Allen, P. and Allen, J. 2013. Basin Analysis: Principles and Applications. 3rd edition. Wiley – Blackwell, 642 p.
- Leeder, M. 2011. Sedimentology and Sedimentary Basins: From Turbulence to Tectonics. 2nd edition. Wiley – Blackwell, 784 p.
- Catuneanu, O. 2006. Principles of Sequence Stratigraphy. Elsevier, 375 p.
- Coe, A. 2003. The Sedimentary Record of Sea-Level Change. Cambridge University Press, 287 p.

  All texts are available on reserve at Milne Library

Course Structure

This is a **3–credit hour IN-PERSON** course. The course spans the entire semester (**15 weeks** long and consists of four content modules). You should dedicate approximately **8–10 hours** per week to working on the course itself, but actual time commitments will vary depending on your input, needs, and personal study habits. To be successful, you will need to log on to the course canvas site a minimum of **4 days per week** in addition to attending **weekly in-person meetings**.

- The course has a consistent and predictable structure, organized around the themed modules, with a course canvas site that should be straightforward and easy to navigate. Instructions and due dates for activities and assignments are clearly articulated so that you know what is expected of you and you can easily stay on track.
- Most assignments are due by 11:59 PM of their respective due dates as listed on the course calendar. At the end of each week, you will have an opportunity to make sure that you have completed all the required activities and assignments before the new week's content is released.
- For most weeks of the course, the future week's materials will be available a few days ahead of schedule, likely on the Friday before that week officially begins. This is done for students who need to get ahead in the course due to some sort of major event planned.

- **Face-to-Face Information**

  - I greatly value the learning opportunities we'll have in our in-person lab meetings and hope that you will actively participate in this important element of the learning process. The COVID-19 pandemic presents challenges to in-person learning, but by working together we can make this a safe experience.

  - It is essential that all students in in-person classes follow some basic processes to help keep themselves, other students, and our faculty and staff safe. Although these processes may seem inconvenient, they reflect current public health guidance that helps minimize the spread of coronavirus. Please incorporate these essential health and safety measures into your normal routine, consider the ways that your actions may affect the health and wellbeing of those around you, and try to approach this semester with a spirit of empathy and compassion.

  - In the context of the COVID-19 pandemic, it is vital that we all do what we can to protect the health and safety of each other. If you are feeling unwell on a day that lab meets in-person, do not attend. Remember that it is better to stay home if you are not feeling well than to attend class and risk spreading illness to others. Throughout the semester, please be proactive in communicating about absences and contact the Dean of Students if you expect to be out for an extended period of time. Rest assured that there will be no penalty for missing class and that I've designed our course so that there's a path for you to make up any learning that takes place in a lab meeting you miss.

  - The college has developed an online COVID-19 screening report for students. Be sure to familiarize yourself with this process and complete the brief screening report before leaving for lab. If you are experiencing common symptoms of COVID-19, stay home and contact Health and Counseling Services as soon as possible. I strongly encourage you to set a daily reminder to fill out the screening report.

  - Face masks are required in all instructional spaces (including classrooms, lecture halls, and laboratories) and all common areas including residence halls and academic buildings **regardless of vaccination status**. If you forget your mask, please be sure to pick up a disposable one before entering the classroom. Masks must be worn for the duration of lab. If you do not have a mask or are unwilling to wear one, you will be asked to leave the classroom. I cannot safely hold lab if all students are not wearing face masks.

  - If you would feel more comfortable or if my teaching could be more accessible if I wear a clear face mask, please let me know as soon as possible.

  - Please familiarize yourself with any special seating arrangements in the classroom and be sure to practice 6-foot physical distancing at all times. This includes entering and exiting the classroom.

- **Online Instruction**

- All course materials are available on Canvas and I've made every attempt to ensure that they are accessible to everyone. If you have difficulties accessing any materials (including needs for alternative formats), please let me know as soon as possible and I will rectify the situation.
- Accessing course materials online may be challenging - we've all experienced things like unforeseen emergencies and internet disruptions. Although this course may include some "live" or synchronous course activities, we can all be understanding about the challenges posed by the COVID-19 pandemic and the limits of technology. If you are experiencing longer-term disruptions, please be proactive in communicating with me and contact the Dean of Students if you expect to be out for an extended period of time.
- CIT has developed a number of **resources that can help you formulate good strategies for success in online courses**. These include general strategies for keeping on track with your courses as well as more specific resources about learning experiences that you may encounter in an online course. The Office of the Dean for Academic Planning and Advising has also introduced the new **KOALA (Knights' Online Academic Learning Assistance)** course support resource. Throughout the semester, if you need help with online learning strategies, you can contact the KOALA support desk, which will assist you with identifying resources and strategies for success.
- **CIT also provides a range of technology support resources**. When you are in Canvas, the Help menu on the left side of the screen will also direct you to a number of CIT supports, including self-help resources and options to request technology assistance.

Health and Wellbeing

The changes brought on by COVID-19 have impacted us all in a number of ways, and will continue to do so at various times and to varying degrees during the upcoming semester. Your health and wellbeing are foundational to your ability to learn, and if you find that you are feeling unwell (physically or mentally) and it is impacting your ability to complete your coursework, please reach out. Because the learning environment will be different than it has been in the past, the indicators that usually let you know something is wrong may not be as clear to you or those around you as they would be during a typical semester. Additionally, the ways in which you normally engage in self-care may have been disrupted. Please remember that it's never too late to ask for help. The **Dean of Students (585-245-5706)** can assist and provide direction to appropriate campus resources. The college also has collected resources in a **Coping with COVID webpage**.

Class policies and expectations

- **Posting material on Canvas**
  - This class is broken up into four sections that will be delivered as four Modules: (1) *Foundations of Sedimentary Basins: Weeks 1-3,* (2) *Mechanics of Sedimentary Basin Formation: Weeks 4-6*, (3) *Sedimentary Basin Fill: Weeks 8-11,* and (4) *Applications to Petroleum Play: Weeks 12-15*. Each of these modules will have three main parts: Overview, Lecture Information & Readings, and Assessments. The Module Overview will go over the expectations for that part of the class, due dates and will go over any major changes to the course structure.
  - Lectures will be in person but I will supplement the information delivered with lecture notes, powerpoints and helpful linked sites. Readings will include the suggested chapters related to lecture content, but also linked OER sources when available.
  - Assignments such as workshops, discussions, or problem sets will be posted in the Module under Assessments.
- **Required Student Work**
  - Weekly readings from selected papers posted on Canvas
  - Workshops (In-class activities)
  - Discussions (on Canvas)

- Problem Sets – Group work
- Petroleum Exploration Game
- Mini Exams

- **Late Assignments**
  - For all assignments (discussions, problem sets, etc.) I will allow submission up to **three days after the assignment deadline.** I will not accept assignments after the three-day grace period, there will be no exceptions!
- **Readings**
  - Readings for the course will be posted on Canvas or distributed in class. The readings will help and aid you in understanding the key concepts in the course and to help you 'catch up' on missed material or on background material that is new to you. Make sure to check Canvas and announcements for reading assignments and due dates.
- **Mini Exams**
  - The course will have small, mini exams that will cover focused material from each themed section of content as chunked assessments (i.e. information delivered during *Foundations of Sedimentary Basins: Weeks 1-3* will culminate in an exam that covers that themed content only). The mini exam questions will be a mixture of short answer, multiple-answer, and diagram questions. Mini exam dates are provided in the course schedule and will be available in weekly communications. The mini exams are non-cumulative and will be delivered at the beginning of in-person meetings (unless method of delivery has changed due to COVID-19). Material covered on the exams will be from the lectures, the assigned readings, workshops, and problem sets.
  - **Make-up exams** will be available only to those students having valid excuses. Personal travel, convenience, over sleeping, or "not being prepared" are not acceptable. If you want to request a conflict exam, you must contact Dr. Wittmer in writing via email at least **three** weeks before the scheduled exam. If you have medical or family emergencies immediately before an exam, you must contact Dr. Wittmer as soon as possible. A student who misses an exam for whatever reason must contact Dr. Wittmer no later than one day after the scheduled exam. Failure to do so will result in a "0" for the exam. If you believe that you have a valid conflict for the final, be sure to inform Dr. Wittmer at least 3 weeks prior to each exam.
- **Discussions**
  - This course covers the science of the petroleum industry, but there are many issues with the pursuit of fossil fuels (i.e. climate change). Therefore, this course will have one discussion per section that will cover the environmental, socio-economic, justice, and impact of fossil fuel exploration. These discussion boards will be available under Assessments in the section modules in Canvas. Discussions will involve an initial post by individual students on one selected topic proposed on the discussion assignment. These initial discussion posts will be due on Thursdays at 11:59pm. Following the initial post, you will have to do two responses to your peer's initial posts by Sundays at 11:59pm.
- **Workshops and Problem Sets**
  - For every in-class meeting we will be covering very difficult topics using in-class workshops where you will actively work on the topics. Commonly these workshops will be due at the end of the assigned class or by the end of the next class meeting and will be evaluated based on completion. Problem sets will involve outside class time and will be group-based assignments.
- **Petroleum Exploration Game**
  - During the last half of the semester, you will work on an **independent** petroleum exploration project where you will compete with your fellow classmates to see who can produce the most oil in a real-life active oil field. This exercise will be 20% of your final grade and will be based on your ending balance (how much money you made producing oil), bids made, successful plays, and a well-drawn out mylar map with structure contours, isopach contours, well locations plotted, and a final cross-section of the structure contours and isopach along a selected final transect of the oil field. This is a time intensive but fun exercise, to be

successful with this exercise you cannot be late with any bids or else you will be penalized by losing your oil fields, thus lowering your grade.

- **Grading Scale**
  - Your course grade will be calculated as follows:
    - In Class Workshops 15%
    - Discussions 15%
    - Petroleum Exploration Game 20%
    - Problem Sets 20%
    - Mini Exams 30%
  - Grading Scale

93.30 – 100 % = A	86.60 – 89.99 % = B+	76.60 – 79.99 % = C+	60.00 – 69.99 % = D
90.00 – 93.29 % = A-	83.30 – 86.59 % = B	73.30 – 76.59 % = C	≤ 59.99 % = E
	80.00 – 83.29 % = B-	70.00 – 73.29 % = C-	

- **Assignments and Point Distributions**
  You can access your scores by clicking the **Grades** link from the left column of the course canvas page. All assignments have due dates, please see the course schedule to determine deadlines.

Assignments	Workshops	Discussions	Petroleum Exploration Game	Problem Sets	Mini Exams	Total points for the week
Week 1	10					10
Week 2	20	30				50
Week 3	20					20
Week 4					60	60
Week 5	10			25		35
Week 6	10	30				40
Week 7					60	60
Week 8	10			60		70
Week 9	10		5			15
Week 10	20	30	5			55
Week 11	10		5		60	75
Week 12			5	70		75
Week 13	10		5			15
Week 14	10		5	50		65
Week 15		30	95		60	185
Total points per assignment	140	120	125	205	240	830
Relative Weight	15%	15%	20%	20%	30%	100%

Accommodations: SUNY Geneseo makes reasonable accommodations for persons with documented physical, emotional or learning disabilities. Students should consult with the Assistant Dean of the Office of Accessibility (Dr. Amy Fisk, 22 Erwin, afisk@geneseo.edu). During the first week of the semester, students should alert the professor regarding any needed accommodations by the beginning of the second week of the semester.

Academic Dishonesty Policy: Academic dishonesty includes cheating, knowingly providing false information, plagiarizing, and any other form of academic misrepresentation. If an incident of academic dishonesty occurs, I will enforce the policies of the university, meaning that I document the incident with the Office of the Dean and the student(s) receive a failing grade of 'E' for that assignment and potentially for the course. Consult the following link for details: (http://www.geneseo.edu/handbook/academic-dishonesty-policy)

Statement of Commitment to Inclusion and Diversity: It is my intention to have a course that is accessible and inclusive to students from all backgrounds and perspectives and addresses students' learning needs both in and out of class. The diversity of perspective and experience that students bring into our classroom is a resource, strength and benefit and we seek to cultivate a learning community that is inclusive to all identities (including race, gender, class, sexuality, religion, ability, etc.)

To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official Geneseo records, please let your instructor know.
- If you feel like your performance in the class is being impacted by your experiences outside of class, please come and talk with me, Dr. Wittmer. I care and can help you find support resources on campus. If you prefer to speak with someone outside of the course, robbie routenberg (routenberg@geneseo.edu), is the Chief Diversity Officer for the College and they and their office can provide help and support.
- If something was said in class (by anyone) that made you feel uncomfortable, please communicate this to your instructor, Dr. Wittmer. (Note: Anonymous feedback is always an option). Reporting divisive comments or behavior is an essential step in continuing the education of people who are still in the process of learning about diverse perspectives and identities.
- Know that your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.
- If any of our class meetings conflict with your religious events, please let Dr. Wittmer know so that she can make arrangements for you.

For more details on SUNY Geneseo's community commitment to diversity, equity, and inclusion, please see the content at found at the following location: https://www.geneseo.edu/diversity/commitment

COURSE SCHEDULE

Week	Date	Lecture Content	Deadlines
1	Aug. 31	Course Introduction	
	Sept. 2	Different sedimentary basins and tectonic settings	
2	Sept. 7	State of the Lithosphere: Isostasy	Discussion 1
	Sept. 9	State of the Lithosphere: Heat flow + Convection	
3	Sept. 14	State of the Lithosphere: Stretching + Mechanical Subsidence	
	Sept. 16	State of the Lithosphere: Flexure + Mechanical Subsidence	
4	Sept. 21	**MINI EXAM 1 (WEEK 1-3)**	
	Sept. 23	Foreland + Peripheral Basins	
5	Sept. 28	Forearc + Retroarc Basins	Problem Set 1 Part 1
	Sept. 30	Examples of Peripheral Foreland Basins	
6	Oct. 5	Formation and Evolution of Extensional Basins	Discussion 2
	Oct. 7	Rift Basins and Passive Margins	
7	Oct. 12	*NO CLASSES – FALL BREAK*	
	Oct. 14	**MINI EXAM 2 (WEEK 4-6)**	
8	Oct. 19	Siliciclastic & Carbonate Basins	Problem Set 1 Part 2
	Oct. 21	Sediment Supply to Basins	
9	Oct. 26	Accommodation Space	
	Oct. 28	Facies and Depositional Sequences I	
10	Nov. 2	Facies and Depositional Sequences II	Discussion 3
	Nov. 4	Sequence Stratigraphy I	
11	Nov. 9	Sequence Stratigraphy II	
	Nov. 11	**MINI EXAM 3 (WEEK 8-11)**	
12	Nov. 16	Thermal Maturation	Problem Set 2
	Nov. 18	Thermal Evolution in Basins	
13	Nov. 23	Petroleum Play	
	Nov. 25	*NO CLASSES – THANKSGIVING BREAK*	
14	Nov. 30	Petroleum Systems	Problem Set 3
	Dec. 2	Play Requirements and Reservoirs	
15	Dec. 7	Types of Petroleum Traps	Discussion 4
	Dec. 9	Types of Plays: Conventional and Unconventional	
-	Dec. 16	**MINI EXAM 4 (WEEK 12-15)**	@ 8am