GEO 383S (#27625): Sedimentary Basin Analysis — Spring 2022
GEO 363S (#27505): Sedimentary Basin Analysis — Spring 2022

Lectures: 3-6 pm Wednesday, EPS 1.126

Instructors: Brian Horton: horton@jsg.utexas.edu; JGB 5.220.
Office hours: MW 10-11am or by appointment
Matthiew Malkowski: malkowski@jsg.utexas.edu; EPS 3.128.
Office hours: MW 10-11am or by appointment

https://search.lib.utexas.edu/permalink/01UTAU_INST/vu6c1o/alma991058205962306011
click “View Online” (Ebook Central Science & Technology).

Other Useful Texts:

Course Description:
This course seeks to deliver a theoretical and practical understanding of how sedimentary basins develop and how they can be studied to determine tectonic, climatic, and sea-level controls on subsidence, surficial processes, and infilling. We will discuss quantitative models for flexural and thermal subsidence, isostasy, and various basin classification schemes. We will also address methods for determining sediment dispersal patterns, provenance, basin paleogeography, and sediment accumulation history. We plan to introduce you to straightforward computer programs (Excel, Matlab, etc) that provide useful tools for quantitative basin modeling.

The second part of the course will focus on case studies that will help inform project-oriented investigation. We will analyze several selected sedimentary basins in terms of tectonic setting, subsidence mechanisms, and stratigraphic architecture with the goal of characterizing the response of sedimentary systems to geodynamic and climatic forcing mechanisms. Coursework will include readings and presentations, and a final project involving a written report and oral presentation.

Prerequisites:

Grading Policy:
Assessments are based on: (A) 3 problem sets (30%); (B) one midterm exam (25%); (C) 1 oral presentations of relevant articles (10%); and (D) a final written report (25%) with corresponding oral presentation (10%). Grades are assigned as follows: A (94-100); A- (90-93); B+ (87-89); B (84-86); B- (80-83); C+ (77-79); C (74-76); C- (70-73); D+ (67-69); D (64-66); D- (60-63); F (0-60).
Subject Matter (weeks 1-16): subject to minor schedule modifications

1. Sedimentary basin analysis: history, basin classification, plate tectonic settings
   - Constitution of Earth, lithosphere mechanics, isostasy (Jan 19)
   **Problem Set 1. Isostasy (due 5pm Fri, Jan 28)**
2. Flexure of the lithosphere: theory and modeling applications [introduction to Excel or Matlab program] (Jan 26)
   **Problem Set 2. Flexure (due 5pm Fri, Feb 4)**
3-4. Basins formed by flexure: foreland basins, thrust belts, critical-taper models, dynamic subsidence (Feb 2)
4. Thermal subsidence of the lithosphere (Feb 9)
5. Basins formed by extension: rifts, supradetachment basins, extensional collapse (Feb 16)
6. A. Sediment accumulation histories; subsidence (“geohistory”) analysis
   B. Sediment provenance; geochronological and isotopic methods, paleocurrents, sediment dispersal patterns (Feb 23)
   **Problem Set 3. Subsidence Analysis (due 5pm Fri, Mar 4)**
7. Additional tectonic settings (strike-slip, trench, forearc, intra-arc basins) (March 2)
8. Mid-term exam (March 9)
9. Spring Break (March 14-18)
10. Passive continental margins (March 23)
11. Extensional to passive-margin basins: Brazil, North Sea, Aegean cases (March 30)
12. Broken foreland, successor, & hinterland basins: Andes, Rocky Mountain cases (April 6)
14-16. Project final presentations (April 20, 27, May 4)

Learning Outcomes:
This course seeks to convey a new and deeper understanding of the following items:

- Plate tectonic settings of sedimentary basins
- Physical mechanisms and geodynamic processes responsible for basin development
- Classification of sedimentary basins
- Recognition of contrasting basin types in the stratigraphic record
- Deformational processes in the crust/mantle and lithosphere/asthenosphere during basin genesis
- Subsidence and sediment accommodation
- Isostasy and isostatic equilibrium
- Flexural subsidence (regional isostasy): theory and application
- Thermal subsidence: theory and application
- Dynamic subsidence: theory and application
- Basins formed by flexure: first principles and case studies
- Basins formed by faulting: first principles and case studies
- Basins formed by extension and cooling: first principles and case studies
- Sediment accumulation histories and subsidence (geohistory) analysis
- Surface processes in relationship to basin filling
- Sediment provenance and sediment dispersal patterns
Guidance for final written report:

Report goals:
- identify an interesting topic or problem;
- provide an introduction and background information;
- outline the key issues, key relationships, etc;
- if there is a debate, outline the competing positions;
- discuss the implications;
- summarize the main conclusions.

To help motivate your project, consider several issues:
- What is the problem / debate?
- Why is the issue important?
- What are the implications?

Examples: you could identify
- a process (e.g., dynamic subsidence)
- a specific geographic region (e.g., Apennine foreland basin)
- a zone (e.g., forebulge)

Depending on your interests, your paper could place more emphasis on sedimentology, stratigraphy, geomorphology, etc.

Report format (suggested):
- TITLE
- NO Abstract
- INTRODUCTION
- BODY:
  - select several informative headings
- DISCUSSION / IMPLICATIONS
- CONCLUSIONS
- REFERENCES

Details:
- 1 inch margins (MS Word)
- 12 point font (Times New Roman, Calibri, Cambria)
- 8-10 pages double-spaced text
- on additional pages (up to 10), at least 5 figures with personalized captions (i.e., figure captions must be modified from original source)
- at least 10 references.

Deadline for turning in the final report: **5pm Friday May 6**
Additional Information:

- **Academic dishonesty:**
  UT Honor Code
  [http://catalog.utexas.edu/general-information/the-university/#universitycodeofconduct](http://catalog.utexas.edu/general-information/the-university/#universitycodeofconduct)
  The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community.
  Plagiarism defined:

- **Services for Students with Disabilities:**
  The instructors respect and welcome students of all backgrounds, identities, and abilities. If there are circumstances that make the learning environment and activities difficult, if you have medical concerns, or require specific arrangements in case of building evacuation, please contact us. By UT policy, all information and discussions are confidential. Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities at 471-6259 (voice) or 512-410-6644 (Video Phone) to request an official letter outlining authorized accommodations. Additional information: [http://ddce.utexas.edu/disability/about/](http://ddce.utexas.edu/disability/about/) [https://diversity.utexas.edu/disability/](https://diversity.utexas.edu/disability/)

- **Religious holidays:**
  By UT policy, you must notify us of your pending absence at least 14 days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.
  Recommendations regarding emergency evacuation: [http://www.utexas.edu/safety](http://www.utexas.edu/safety)
  - Occupants are required to evacuate buildings when a fire alarm is activated.
  - Familiarize yourself with classroom exits and building exits.
  - Students requiring assistance in evacuation shall inform their instructor in writing.
  - In the event of an evacuation, follow the instructions of instructors.
  - Do not re-enter a building unless given instructions by the following: Austin Fire Department, UT Police Department, or UT Fire Prevention Services office.
  - Emergency evacuation routes and emergency procedures: [www.utexas.edu/emergency](http://www.utexas.edu/emergency)

- **Class Recordings:**
  Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the class in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.
Safety Information:

Safety and Class Participation/Masks: We will all need to make some adjustments in order to benefit from in-person classroom interactions in a safe and healthy manner. Our best protections against spreading COVID-19 on campus are masks (defined as cloth face coverings) and staying home if you are showing symptoms. Therefore, for the benefit of everyone, this is means that all students are required to follow these important rules.

- **Every student must wear a face-covering properly in class and in all campus buildings at all times.**

- **Students are encouraged to participate in documented daily symptom screening** which is available using the Protect Texas Together app. Once the symptom screening is completed, it will inform students whether they are cleared to come to campus. Students should only come to campus if the symptom screening app clears them to do so. Otherwise, students should isolate and contact a medical professional for further guidance before coming to campus again.

- Information regarding safety protocols with and without symptoms can be [found here](#).

- **COVID-19: Reporting symptoms, and test results:** To help keep everyone at UT and in our community safe, it is critical that students report COVID-19 symptoms and testing, regardless of test results, to [University Health Services](#), and that faculty and staff report to the HealthPoint Occupational Health Program (OHP) as soon as possible. Please see this [link](#) to understand what needs to be reported. In addition, to help understand what to do if a fellow student in the class (or the instructor or TA) tests positive for COVID, see this [University Health Services link](#).

Additional Safety Guidance:

- Consumption of food and drink is not allowed in classrooms or public areas of university buildings except for designated break areas.

- Everyone should enter/exit the building by designated entrances/exits.

- Use hand sanitizer after entering a building.

- Follow the corridor and stairway directional signs where applicable, maintaining proper social distancing.

- All physically able individuals should use stairs whenever possible. If an elevator is required, follow signs regarding occupancy, maintaining proper social distancing.

- At the end of a class period, students will be dismissed in sections, according to proximity to classroom exits.