

Plate Tectonics (GEOL 2110): Tuesday/ Thursday 11:00-12:15 Thaw B9
Fall term, 2025

Professor Nadine McQuarrie: SRCC 403, 4-8870, nmcq@pitt.edu

Office hours: (by appointment; non-office hours are Tuesday or Thursday before class unless previously arranged by appointment.)

Course Description: The 1960's and 1970's heralded in a revolution in earth science thinking. Scientists realized that the outer shell of the Earth is composed of a mosaic of 15 irregular, sections or plates. Initial tenants of plate tectonic theory assume that these plates are rigid and deform along narrow zones at plate boundaries, but have since learned that when the boundary of a plate is a continent, the resulting deformation, or "orogen" can be very broad and diffuse. The study of plate tectonics informs all fields of earth science from structural geology, sedimentology and igneous and metamorphic petrology to understanding sea water and atmospheric chemistry, circulation and resulting climate. The global study of plate tectonics is both a unifying solid-earth theory as well as a start to understanding feedbacks between the lithosphere, hydrosphere and atmosphere.

Learning Objectives: The objectives of the course are to 1) learn about modern concepts of plate tectonics, 2) evaluate the dynamics of geological and geophysical processes and understand what governs the large-scale structure of the earth, 3) evaluate the structural, petrological, sedimentological, and climatic implications of different plate tectonic environments, 4) discuss and evaluate outstanding questions regarding aspects of plate tectonics, 5) learn how to read and evaluate scientific papers not necessarily in your field of study.

Assignments:

Each topic covers ~ 2 class periods. The assignment for the first class period is to read the assigned reading in Kearey, Klepeis and Vine, Global Tectonics and come up with 3-5 questions that you will bring to class. These questions should focus on aspects of the reading that you did not understand and will guide the class discussion of the topic. The assignment for the second class period will be additional reading (current papers on the topic) based in part on your questions. We will chose the topics for additional reading at the end of the first class period. Again, questions on the proposed reading are due when the paper is presented in class.

Final project: in lieu of a "final exam", students will write a paper focused on an important, interesting, outstanding question related to plate tectonics. The paper should introduce the debate, controversy, or uncertainty, present arguments in support of both sides, and then a resolution. The resolution should be supported by the data presented or it can be a proposal to generate new data that can answer the question or address the uncertainty. Make it easy on yourself and have it related to your research or research interests.

- **Paper proposals due October 23rd (~1-2 pages)
- ** Paper outline and main references due Nov 20th
- **Paper due December 12th

Schedule:

Introduction, Historical perspective and Continental Drift (Chapters 1 and 3; 20 pg).

Interior of the Earth (Chapter 2; 40 pg)

Framework of Plate Tectonics, Sea floor spreading and transform faults (Chapter 4 and 5, 50 pg)

Ocean ridges (Chapter 6; 27 pg)

Continental rifts and rifted margins (Chapter 7; 55 pg)

Continental transforms and strike slip faults (Chapter 8; 36 pg)

Subduction zones (Chapter 9; 30 pg)

Orogenic belts (Chapter 10):

–Ocean continent convergence and compressional basins (20 pages)

Orogenic belts (Chapter 10):

- Continent-continent convergence (24 pages)

Orogenic belts (Chapter 10):

- Arc-continent convergence and terranes (16 pages)

Precambrian tectonics and supercontinent cycle (Chapter 11; 30 pg)

Mechanisms of Plate Tectonics (Chapter 12; 25 pg)

Academic Integrity: All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating plagiarism or other acts of academic dishonesty would be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level as outlined in the University Guidelines on Academic Integrity. www.cfo.pitt.edu/policies/policy/02/02-03-02.html.

Disability Services: If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services, 216 William Pitt Union, 412-648-7890/412-383-7355

(TTY), as early as possible in the term. Disability Resources and Services will verify your disability and determine reasonable accommodations for this course.

Statement on classroom recording: To insure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Diversity: In this course, students, faculty and guests represent diverse perspectives, backgrounds, and experiences, which enriches our classes. Individuals of all races, colors, ancestries, sexes, marital status, familial status, ages, backgrounds, beliefs, ethnicities, gender identities and expressions, national origins, religious or political affiliations, sexual orientations, abilities, and other visible and nonvisible differences are welcomed. Every person in this classroom should feel responsible for creating a space that is intellectually rigorous and is a respectful, welcoming and inclusive environment for every individual. We urge all to be mindful of the ways that our identities position us in the classroom. While intellectual disagreement may be constructive, no harsh statements, or demeaning or discriminatory behavior will be permitted. If you feel uncomfortable, please feel free to approach me to discuss the situation.

In this class, we will have the chance to indicate the name that we prefer to be called and, if we choose, to identify pronouns with which we would like to be addressed. I will do my best to address and refer to all students accordingly and support classmates in doing so as well. I will endeavor to use gender-inclusive and nondiscriminatory language in all course communication and materials. Your suggestions for how to improve the effectiveness of the course for you personally or for other student groups are encouraged and appreciated. Our faculty is committed to communication from students without judgement. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.