

Class Information: SIOG 221 Plate Tectonics in Practice

This class will build upon classic concepts in plate tectonics, with an emphasis on practical implementation of tools that will be applicable to a wide range of problems. These include quantitative seafloor analysis, plate reconstructions, modeling potential field data, and earthquake data analysis. The homeworks and essay assignment are designed to develop coding, data handling, and writing skills.

Instructor: Ross Parnell-Turner

Office: 333, IGPP Munk Lab; email: rparnellturner@ucsd.edu

Meeting Times and Locations: Mon/Wed 9:00am–10:20pm (Munk 330)

Format: 2 lectures per week; 4-units, letter or S/U grade.

Grades based on essay, homework assignments, and presentations.

Website on Canvas: <https://canvas.ucsd.edu/courses/37256>

Here you will find class information, lecture recordings and slides, and homeworks.

Learning Outcomes

1. Summarize fundamental concepts in plate tectonic theory
2. Apply plate tectonic concepts to solve geophysical problems such as plate reconstructions
3. Access and appraise digital data such as earthquake catalogs and multibeam bathymetric data
4. Manipulate data and files using bash scripts and tools such as awk
5. Design shell scripts to analyze and plot data using GMT, and produce publication-ready figures
6. Evaluate scientific papers and develop communication skills, by reading, writing and presenting.

Suggested textbooks

This class will focus on methods and implementation, however the following provide useful background:

Cox, A., and Hart, R. B. (1986). *Plate Tectonics, How it Works*. Blackwell.

Fowler, C. M. R. (2005). *The Solid Earth*. Cambridge University Press.

Kearey, P., Klepeis, K. A., and Vine, F. J. (2009). *Global Tectonics*. Wiley-Blackwell.

Turcotte, D. L., and Schubert, G. (2014). *Geodynamics*. Cambridge University Press.

Computing

Computer-based homeworks will need the tools listed on the schedule, all of which will run on most Mac, Linux or Windows machines. If you do not have a computer account we will set you up with one.

Essay assignment

You will write a review essay, in the style of a *Nature* ‘News and Views’ article, on a recently published peer-reviewed scientific paper, published since 2010 on a topic relevant to plate tectonics. The objective is to improve your writing and critical skills.

Key Dates

1. Choice of peer-reviewed paper: Monday April 11th
2. First draft due: Monday April 25th
3. Discussion/feedback on first drafts: Monday May 2nd
4. Final draft due: Monday May 30th

Format

Essays should be up to 800 words long (including figure captions, but not including title or references), and include one figure. They should be typed in 12 pt size font, with citations using the author-date format, and submitted in pdf format. Grades will be assigned with the aid of the rubric, which can be found on the course website.

Class Schedule

Module		Topic	Homework	Tools	Reading
Intro	M 28-Mar L1	Class Intro: homeworks, essay intro, elevator talks	1: Elevator talk		McKenzie et al., 2005
	Week 1 W 30-Mar L2	Plate tectonics intro: crust vs lithosphere; Elevator Talks 1			
Map projections and sonars	M 4-Apr L3	Map projections, datums, and GMT; homework 0 intro, Elevator Talks 2	2. Software install	xterm, bash	DeSanto, 2019
	Week 2 W 6-Apr L4	McKenzie 2005, navigation and mapping methods, Elevator Talks 3			
Oceanic crust	M 11-Apr L5	Homework 0 discussion, elevator talks, intro to oceanic seafloor, homework 1 intro, Essay paper choice due	3: Map projections	GMT, bash	Goff et al., 2018
	Week 3 W 13-Apr L6	DeSanto 2019, seafloor fabric and abyssal hills			
Marine magnetic anomalies	M 18-Apr L7	Homework 1 discussion, magnetism introduction, homework 2 intro	4: Abyssal hills	GMT, bash	DeMets 2016
	Week 4 W 20-Apr L8	Goff et al., 2018; Marine magnetic modeling			
Gravity	M 25-Apr L9	Student abyssal hill presentation; gravity intro; homework 3 intro; Essay first draft due	5: Marine magnetism	MODMAG	Kuo & Forsyth, 1988
	Week 5 W 27-Apr L10	DeMets, 2016; Marine gravity surveys			
Tectonics on a Sphere	M 2-May L11	Student marine magnetism presentation; homework 4 intro; Essay 1st drafts discussion	6: Marine gravity	GMT, bash	
	Week 6 W 4-May L12	Kuo & Forsyth, 1988; plate rotations intro			
Plate Reconstructions	M 9-May L13	Student marine gravity presentation; flowlines and poles, homework 5 intro	7: Rotation poles and flowlines	GPlates, GMT	
	Week 7 (remote) W 11-May L14	Plate reconstructions in practice			
Earthquakes & Focal Mechanisms	M 16-May L15	Student flowlines presentation; earthquake catalogs intro, homework 6 intro	8. Plate reconstructions	GPlates	
	Week 8 (remote) W 18-May L16	Earthquake catalogs and focal mechanisms in practice			
Active Source Seismology	M 23-May L17	Student plate reconstructions presentation, active source seismic intro	None: work on essay 7. California Borderlands	GMT, bash	
	Week 9 (remote) W 25-May L18	Seismic reflection and chirp methods, California Borderlands intro			
California Borderlands	M 30-May	<i>Memorial Day, no class</i>			
	Week 10 W 1-Jun L19	Essay feedback; California Borderlands discussion, course review			