

# **PETE/GEOS 370**

## **Fall 2012**

### **Sedimentary and Structural Geology for Petroleum Engineers**

Lecture: Tuesday, Thursday 2-3:30 pm, Reichardt 202  
Lab: Thursday, 3:40-6:40; Thursday 9:45-12:45, Reichardt 229

**Prerequisite:** GEOS 101 OR GE 261 OR permission of instructor

**Instructor:** Paul McCarthy, REIC 336, 474-6894, [pjmccarthy@alaska.edu](mailto:pjmccarthy@alaska.edu)  
Office hours: M, W – 9-10:30 am, or by appointment

**Lab Instructors:** Mary Maley, Louise Farquharson

**Recommended Texts:**

Nichols, G., 2009, Sedimentology and Stratigraphy (2<sup>nd</sup> edition), Wiley-Blackwell.  
Park, R.G., 1997, Foundations of Structural Geology, 3<sup>rd</sup> edition

(Other selected readings may be placed on reserve in the library)

The objective of this course is to provide a petroleum engineer with an understanding of sedimentary and structural geology sufficient to enable him or her to interact effectively with petroleum geologists in industry. This course will introduce the petroleum engineer to some of the fundamental concepts, techniques, tools, and terminology in use today by petroleum exploration and production geologists. The topics to be covered in lecture will include:

- Stratigraphy and the significance of geologic time
- Sedimentary rocks, their depositional environments, geometries, and porosity and permeability patterns.
- Basic mechanical behavior of rocks; brittle vs. ductile behavior; folding and faulting
- Plate tectonics & basin evolution

The course grade will be a letter grade (plus, minus) and will be based on 2 mid-term exams and a final exam (22.5% each) and the lab grade (32.5%). Grading will be based on the following:

A = 90-100%  
B = 80-89%  
C = 70 – 79%

D = 55-69%  
F = <55%

The laboratory portion of this course is fundamental for illustrating the types of data available to petroleum geologists, and the skills and tools commonly used by them every day in industry.

Topics to be covered in lab will include rock and mineral identification, surface and subsurface mapping, and map interpretation. Please bring a hand lens, pencil, ruler, and eraser to lab.

## Preliminary Lecture and Lab Schedule

Lecture	Topic	Reading	Labs
	<b>PART 1: STRATIGRAPHY AND SEDIMENTATION</b>		
August 30	Introduction Basic stratigraphic principles & nomenclature	Nichols, Ch. 1 & 19	
Sept. 4	Weathering, sediments, and sedimentary rocks	Nichols, Ch. 6, 2, 3 (*Ch. 6, 2 & 3)	
6	Sedimentary rocks (cont)	Nichols, Ch. 2, 3 (*Ch. 2 & 3)	Lab 1: Rocks and minerals
11	Transport and deposition of sediment: processes; Sedimentary structures	Nichols, Ch. 4 (*Ch. 4)	
13	Sed Processes (cont)—Erosional, depositional, deformational structures Subsurface tools—gamma ray, resistivity, sp Diagenesis – compaction, cementation, secondary porosity;	Nichols, Ch. 18 (*Ch. 17)	Lab 2: Clastic sedimentary rocks
18	Depositional environments: alluvial fans and fan deltas; fluvial systems	Nichols, Ch. 9 (*Ch. 8.4 & 9)	
20	Depositional environments: deltas and estuaries	Nichols, Ch. 11, 12 & 13 (*Ch. 11, 12 & 13)	Lab 3: Fossils and geologic time
25	Depositional environments: shore zone and shallow marine systems	Nichols, Ch. 14 (*Ch. 14.1-14.4, 14.10)	
27	<b>EXAM 1</b>		Lab 4: Facies and depositional environments
October 2	Basics of sequence stratigraphy	Nichols, Ch. 23 (*Ch. 21)	
4	Acquiring subsurface data—seismic data acquisition and mapping	Lillie, pp. 100-134 North, pp. 413-435	Lab 5: Sequence and seismic stratigraphy
9	Depositional environments: eolian	Nichols, Ch. 8	

	systems	(*Ch. 8-1-8.7)	
11	Depositional environments: slope and base-of-slope systems  Depositional environments: carbonates pt 1	Nichols, Ch. 16 (*Ch. 15)  Nichols, Ch. 15 (*Ch. 14.5-14.10)	Lab 6: Well logs and stratigraphic correlation
16	Depositional environments: carbonates pt 2		
18	Depositional environments: anoxic environments, deposition of organic rich rocks, generation of hydrocarbons	Nichols, Ch. 18.7 (* Ch. 17.8)	Lab 7: Carbonate sedimentary rocks
	<b>PART 2: STRUCTURAL GEOLOGY</b>		
23	The geologic conditions needed for HC accumulations How rocks deform: stress and strain	Park, pp. 55-79	
25	Behavior of materials Brittle behavior: Faults and fractures Part 1	Park, Ch. 2 & 9	Lab 8: Topographic and geologic maps (Park, Ch. 1.3)
30	Review session		
Nov. 1	<b>EXAM 2</b>	Park, Ch. 3 & 10	Lab 9: Faults
6	Faults and fractures (continued)		
8	Ductile behavior: Folds		Lab 10: Folds
13	Folds (cont); folds and fractures		
15	Thrust systems; Structure of the earth and plate tectonics	Park, Ch. 13 & 14	Lab 11: Folds & thrust faults
20	Rifts and passive margins & salt-related structures	Park, Ch. 15 Nichols, Ch. 24 (*Ch. 23)	
22	<b><i>Thanksgiving Break</i></b>		
27	Extensional petroleum provinces; Convergent margins		Lab 12: Prudhoe Bay
29	Convergent margins (cont); strike slip margins		
Dec. 4	Petroleum systems		Prudhoe Bay (continued)

6	REVIEW SESSION		
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*\*from Nichols, 1<sup>st</sup> edition*

**\*\*\* Final Exam: 1-3 pm, Saturday, December 15\*\*\***

**Course Policies:** Attendance at class is your responsibility. Students are responsible for making up any missed work (lectures and labs). Students are encouraged to arrive to class and lab on time. Make-up examinations will be held only under exceptional circumstances (e.g. illness, family crises, etc.). Medical documentation will be required to confirm illnesses. We follow the university guidelines for plagiarism/academic integrity as outlined in the current UAF catalog (p. 52). Students are encouraged to work cooperatively on labs and assignments, but all work that is turned in—labs, homeworks, in class and take home exams—is expected to be their own work.

**Disability Services:** The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.