

GEOS 446
Petroleum Geology
3 credits

Hydrocarbons fuel today's economy, but remain a relatively rare natural resource. The objective of this course is to review the geologic controls on the distribution and accumulation of hydrocarbons, how those hydrocarbons are found, and how they are subsequently extracted. At the end of the course, students should be able to explain:

- the subsurface environment
- the origin and nature of hydrocarbons
- how and where hydrocarbons accumulate
- methods of hydrocarbon exploration and exploitation
- unconventional hydrocarbon resources
- basic reservoir engineering techniques

Examples from classic hydrocarbon-producing regions will be used to illustrate the principles and techniques discussed in class.

Prerequisites: Geos 314 and 322 or equivalent

Instructor: Cathy Hanks, NSB 346/Duckering 417, 474-5562 or 2668
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Office Hours: TBD

Text: Selley, 1999, Elements of Petroleum Geology. Academic Press, 470 p.

Class format:

The class will consist of lectures and homework assignments.

Grading Policy

The course grade will be a letter grade (plus, minus) and will be based on:

- 2 mid-term exams (25% each)
- final exam (25% each)
- homeworks (25%)

Grades will be assigned as follows:

A+ = 97-100%

A = 93-96
 A- = 90-92
 B+ = 87 - 89
 B = 83-86%
 B- = 80-82
 C+ = 77-79
 C = 73 – 76%
 C- = 70 - 72
 D+ = 65-69
 D = 55-64%
 D- = 50 - 54
 F = <55%

The instructor reserves the right to curve the grades where appropriate.

Late homeworks will not be accepted.

COURSE OUTLINE: (28 CLASS DAYS)

<i>Week</i>	<i>Topic</i>	<i>Homeworks</i>	<i>Readings</i>
1	Intro—Why petroleum?		
	What is Petroleum? <ul style="list-style-type: none"> • Organic vs. inorganic origin of petroleum • Chemical Properties • Physical Properties 		Selley Ch. 2
2	The subsurface environment <ul style="list-style-type: none"> • Temperature within the earth • Pressure • Subsurface waters 	Hwk 1: Calculating geothermal gradients	Selley, Ch. 4
	Methods of Exploration <ul style="list-style-type: none"> • Drilling a well • Well logging 	Hwk 2: Rock id	Selley, Ch. 3.1, 3.2, 3.5
3	<ul style="list-style-type: none"> • Subsurface geology and maps • Formation Evaluation 	Hwk 3: Examining well cuttings and well logs	
	<ul style="list-style-type: none"> • Gravity and Magnetism 		
4	<ul style="list-style-type: none"> • Geophysical methods—Reflection Seismic--acquisition 	Hwk 4: Interpreting seismic	Selley, Ch. 3.3
	<ul style="list-style-type: none"> • Seismic interpretation, 3 D, 4D 		
5	The source: How oil forms <ul style="list-style-type: none"> • Source rock characteristics • Productivity and Preservation of Organic Matter. • Hydrocarbon Maturation 		Selley, Ch. 5

	<ul style="list-style-type: none"> Hydrocarbon Migration 		
	Midterm I		
6	The Reservoir: What makes a good reservoir rock? <ul style="list-style-type: none"> Porosity. Permeability. Effects of Diagenesis on Reservoir Quality. 	Hwk 5: Evaluating porosity and permeability in hand samples	Selley, Ch. 6.1-6.7
	<ul style="list-style-type: none"> Measuring reservoir properties <ul style="list-style-type: none"> Lab measurements Log evaluations 		
7	<ul style="list-style-type: none"> Reservoir Continuity—the importance of depositional environment: <ul style="list-style-type: none"> Variations due to sed structure Mesoscopic and map scale variations 		
	<ul style="list-style-type: none"> Carbonate depositional systems: a different beast 	Hwk 6: Correlating logs; Constructing subsurface isopach maps	
8	<ul style="list-style-type: none"> Reservoir prediction in the subsurface: the importance of sequence stratigraphy 	Hwk 7: Sequence stratigraphic interpretation of seismic data	
	Traps and Seals: <ul style="list-style-type: none"> Nomenclature of a Trap. Distribution of Petroleum within a Trap.—Gas, oil, water Characteristics of Seals and Cap Rocks. 		Selley, Ch. 7
9	<ul style="list-style-type: none"> Trap types: <ul style="list-style-type: none"> Structural Traps. Stratigraphic Traps. Combination Traps. Hydrodynamic Traps. 	Hwk 8: Constructing subsurface structure maps; Identifying play types from subsurface structure maps	
	<ul style="list-style-type: none"> Salt-related structures 		
10	Midterm II		

	<ul style="list-style-type: none"> Structural modifications of a reservoir: Fractured reservoirs 		
11	<ul style="list-style-type: none"> Timing of Trap Development Relative to Migration. Petroleum systems & plate tectonic habitat <ul style="list-style-type: none"> Passive continental margins 	Hwk 9: Using seismic data for structural interpretation and timing	Selley, Ch. 8
	<ul style="list-style-type: none"> Passive continental margins, cont 		
12	<ul style="list-style-type: none"> Convergent margins Strike slip basins 	Hwk 10: Plate tectonic setting of modern day basins	
	Reservoir engineering: <ul style="list-style-type: none"> Reserve calculations 	Hwk 11: Simple reserve calculation	Selley, Ch. 6.8-6.9
13	Well Drilling and Completion		
	Non conventional hydrocarbon resources <ul style="list-style-type: none"> Viscous oil Gas hydrates Coal bed methane 		
14	<ul style="list-style-type: none"> Tight gas Shale resource plays 		

Course Policies: Attendance at class is your responsibility. Students are responsible for making up any missed work. Students are encouraged to arrive to class 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. 71-72).

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.