GEOS 635 4(3+3) Advanced Economic Geology Fall 2010

Class: MWF 1-2 NSCI 306 lab R 2-5 pm Reich

Instructor: Rainer Newberry Reich 328 X6895 ffrn@uaf.edu home: 479-0140

Office Hours: ***Monday 3-5 & whenever I'm in—I'm usually here evenings & weekends***

Textbooks: Robb, Ore-Forming Processes Craig & Vaughn, Ore Petrography 2nd Ed

Course Description: This course builds on basic undergraduate petrology, mineralogy, ore deposits, and geochemistry courses. It will provide the student with an advanced understanding of what ore deposits look like from the outcrop to the microscope scale and an understanding of the geochemical basis behind ore formation.

Course Goals:

1. To learn the basic principles behind ore formation
2. To identify ore minerals in a reflected light microscope
3. To test models for ore formation by relatively simple calculations.
4. To provide an insight into our current understanding of ore deposit formation.

Student Learning Outcomes: By actively participating in this course you will be able to:

1. Use reflected and transmitted light petrography for mineral identification
2. Use Microsoft Excel for computation and graphing
3. Interpret textures observed in ores in terms of paragenesis and zoning
4. Use stable isotopic data in ore formation studies
5. Use a variety of geochemical diagrams to interpret conditions of ore formation
6. Use some features of 'Geochemist's Workbench' in diagram construction and interpretation.

Instructional Methods: Weekly reading and problem assignments will be made to accompany the lectures. Problems assigned on a given Friday will be due on the following Friday. Weekly laboratory exercises will be due after a week. Materials will be graded and reviewed promptly. I encourage you to stop by my office or email me if you have any issues with any aspect of this course. I live close to school and come in most evenings and Sundays. If you do your work on a spreadsheet you can email it to me with questions. My philosophy is 'learning by doing' (although some believe that it's 'Arbeit macht frei').

Course Policies: Naturally, I would like you to attend class and to show up on time. If you know you will miss a class or lab, let me know and I will give or email you the lecture notes and assignments (possibly) in advance. *As routine completion of problems and labs is essential to understanding the material in this course, I will submit an instructor-designated drop if you are missing more than 2 assignments by the 5th week of classes.* **I also reserve the right to dock points for severely late materials.**

Evaluation: There will be no exams in this course. I find—in general—that exams are stressful for all concerned and rarely very helpful. Overall class grade based on:

Homework: 40% Labs: 40% Final project: 20%

Final grades will be normalized to the highest point total among students in the class. A point total within 93% of this will be an 'A:, 90-93 = A-, 90-87 = B+, 87-83= B, 83-80 = B- , 77-80 = C+, 77-73 = C, 73-70 = C-, 70-67= D+, 67-63 = D, 63-60 = D-, < 60% = F. It is my intention to give every student in this class a high grade, because I believe that all of you are capable and hard-working.

Support Services: Ability to rapidly and reliably perform algebraic operations (equation manipulation, logs, antilogs, exponentials) is critical to many calculations. I highly recommend you consider the Math Lab (305 Chapman), which provides excellent advice, tutoring and assistance, if you have problems with the algebra in this class. Also consider the Office of Student Support Services (508 Gruening, 474-6844) if you find the Math Lab unsatisfactory.

Disabilities 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. UAF is committed to equal opportunity for all students. If you have a documented disability, please let me know within the first two weeks of class, and I will work with the Office of Disabilities Services to make the appropriate accommodation. If you have a specific undocumented physical, psychiatric or learning disability, you will benefit greatly by providing documentation of your disability to Disability Services in the Center for Health and Counseling, 474-7043, TTY 474-7045.

If you are the first in your family to attempt a four-year college degree, and/or eligible for Pell grants, you have opportunities for tutorial and other forms of support from the office of Student Support Services. I will collaborate with the Office of Disabilities and/or the Office of Student Support Services to make your educational experience in my class as positive as possible. Check the following website for further information. http://www.uaf.edu/advising/learningresources/

Geos 635—Advanced study of Mineral Deposits—Fall 2010 4 Credits Lecture: M, W, F 1-2 pm; Lab thurs afternoon

Instructor: Rainer Newberry x6895 rjnewberry@alaska.edu **#Tentative Schedule of classes, labs, and homework assignments**

wk	date	L#	Lecture	lab	Reading	HOMEWORK
0	Sept 3	1	Overview, Steps in making Ore Deposits, mineral solubility	Field trip	Field trip	Field trip
1	Sept 8	2	Introduction to Reflected Light Microscopy	Intro to reflected light	C39-52	
1	Sept 10	3	Magmatic fractionation & igneous rocks		R 22-25, 40-48	Kd calculations
2	Sept 13	4	fO2-fS2 and sulfide-oxide mineral stability		C222-25	
2	Sept 15	5	Textures and their interpretation	Textures & unknowns	C120-34, 173-175	
2	Sept 17	6	fO2-fS2-T and cooling paths		C189-192	Log fS2-fO2 diagr I
3	Sept 20	7	Magmatic Deposits I: Magmatic Oxides (chromite, magnetite)	Magmatic Ox Deposits	C210-215, R49-54	
3	Sept 22	8	Immiscibility and formation of magmatic sulfides		R55-58, 61-66	
3	Sept 24	9	Ore mineral stability; Fe-Ni-Cu-S and Fe-Ti-O systems		C218-9, 223-5	fO2-T diagrams
4	Sept 27	10	Magmatic Deposits II: Magmatic Sulfides	Magmatic Sulf Deposits	C217-220, R67-73	
4	Sept 29	11	fO2-fS2 and hydrothermal fluids; from magma to fluid		R6-37, 79-85	
4	Oct 1	12	Fluids & fluid inclusions		C193-205, R89-93	Fluid inclusion calc'n
5	Oct 4	13	Activity vs. concentration; complexation, hydrothermal calcns		R96-104, 148-151	
5	Oct 6	14	Alt'n systematics—activity diagrams	Fluid inclusion petrog		
5	Oct 8	15	Introduction to alteration minerals and assemblages		R166-173	Complexation calc'n
6	Oct 11	16	Gangue mineral solubility		R85-88	
6	Oct 13	17	Ore mineral solubility & complexation	Field trip???	R148-156	
6	Oct 15	18	Ore mineral solubility, cont.		R174-177	Qtz Solubility calc'n
7	Oct 18	19	Gold solubility—what a mess!!		R119-122, 160	
7	Oct 20	20	Intrusion-hosted 'Porphyry' Deposits—general features	XRF, XRD mineral I.D	R104-110	
7	Oct 22	21	Porphyry Deposits 2: variations on a theme		C227-232	Au solubility calc'n
8	Oct 25	22	Intrusion-related veins and similar beasties		R110-112	
8	Oct 27	23	Skarns—general overview	Porphyry deposits	R 113-117	
8	Oct 29	24	Petrography of skarns		C309-13	MY Activity diagram
9	Nov 1	25	Skarns—specific examples, especially gold skarns			
9	Nov 3-5		AMA MEETING ANCHORAGE	(Student projects)		my AMA

10	Nov 8	26	Sulfide Replacement deposits		R 206	
10	Nov 10	27	Weathering and supergene enrichment 1: Eh-pH	Skarn deposits	R219-225, 270	
10	Nov 12	28	Weathering and supergene enrichment 2 & diagrams		C157-9; 281-4, R238-243	Eh-pH diagrams-weathering
11	Nov 15	29	Placers and placer minerals		R246-266	
11	Nov 17	30	'Orogenic' Gold deposits—geologic features	Supergene altn	R171-172	
11	Nov 19	31	'orogenic' gold—deposit modeling		C188-193	Work on student projects
12	Nov 22	32	Sulfide minerals & defining P-T of formation			
12	Nov 24	33	Formation of VMS deposits			
12	Nov 26		**THANKSGIVING**	**THANKSGIVING**		**NONE!!**
13	Nov 29	34	Metamorphism of VMS and other deposit types	Sulfide Metamorphism	C298-308, R178-185	
13	Dec 1	35	Epithermal Deposits 1 : general features		R117-122	
13	Dec 3	36	Epithermal deposits 2: current models		R192-197	sulfide mineral comps T-P
14	Dec 6	37	Fluid sources--Light stable isotopes 1—O,H			
14	Dec 8	38	O, H isotopes part 2—applications and pitfalls	Student projects		
14	Dec 10	39	Component sources--S,C isotopes			Stable isotope problems
15	Dec 13	40	Retrospective: what we do and don't know			
	Dec 15		**"Final Exam" = presentation of student projects 1-3 pm**	**CAN BE MOVED**		

 # almost certainly this will change as I respond to student needs, but it's a good starting plan

+ field trips-- (1) Livengood/Eureka Manley (Sept 3-5) (2) Fbx area mineralization ? (3) Roadmetal prospect drill core?

Grading: Homework 40% Labs 50% Final project 10%