Earth Science 2212B: Genesis of Meteorites and Planetary Materials Winter 2014

General information

Instructor: Roberta Flemming: B&GS 0172, rflemmin@uwo.ca

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Lectures: Tuesdays and Thursdays, 12:30 - 1:20 pm, CHB-9

Laboratory: Tuesday 2:30-5:30 pm, B&GS 1069

Office hours: Thursdays 1:30-2:20. You can also drop by at any time (except the hour before class or lab!), but I cannot guarantee that I will be in my office, outside of office hours.

Purpose: In this course, we will review the origin of our solar system and formation of planets and other planetary bodies. We will examine meteorite mineralogy and textures, and use this evidence to understand their formation mechanisms and possible origins. We will also examine data from Earth impacts, the moon and Mars.

Laboratory exercises will enhance the students' understanding of concepts learned in class. In the laboratory students will become familiar with mineralogy, textures and classification of meteorites. Students will become familiar with methods used to analyze planetary materials and they will classify a meteorite. Students will also give a brief (15 min) seminar presentation on the meteorite that they have been typing and compare it to one from the literature.

Prerequisites: Earth Sciences 2206a/b and Earth Sciences 2200a/b, or permission from the Department.
Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Course topics/themes - Tentative schedule

Origin of the Solar System/Early Solar System

Week 1: Jan 7, 9	Snow Day; Cosmochemical formation/distribution of elements.
Week 2: Jan 14, 16	Solar System formation, Planetary formation/differentiation. Earth-moon forming event
Week 3: Jan 21, 23	Age of the solar system (Dr. Moser); CAI and chondrule formation
Friday Jan 24 3:30 pm	Dr. Elkins-Tanton (Carnegie) Five great mysteries from the first 10 Myr of the solar system.

Introduction to Asteroids/ Comets/ Meteorites

Week 4: Jan 28, 30	Asteroids and classification by spectroscopy (Craig); Meteorites: History and classification.
Week 5: Feb 4, 6	Meteorite classification, cont'd: composition, rock types; Orbits and delivery (Guest Dr. Wiegert).

Chondrites and their Parent Bodies

Week 6: Feb 11, 13	Chondrites cont'd (H, L, LL Enstatite, Carbonaceous, Rumuruti, Kakangari); **Midterm (Feb 13)**
**********	Reading Week – February 17-21 **********

Achondrites and their Parent Bodies

Week 7: Feb 25, 27	Introduction to Achondrites; Magmatic achondrites; 4 Vesta HED(OD)s
Week 8: Mar 4, 6	Primative achondrites (aubrite, ureilite, angrite, brachinite, winnonaite, acapolcoite, lodranite)
Week 9: Mar 11, 13	Microdiffraction of meteorites; Irons and pallasites - Planetary cores
Week 10: Mar 18, 20	Guest Lectures: TBA

The Earth, Moon, and Mars

Week 11: Mar 25, 27	Earth Impacts (Guest Lecture Dr. Osinski); Chicxulub and mass extinction?
Week 12: Apr 1, 3	Mars: Data from mars Rovers (Guest Dr. Schmidt, Brock); Martian meteorites (Guest Dr. Bouvier)
Week 13: Apr 10	The moon: Apollo samples; meteorites; analogue data

Laboratory Exercises

Labs	Date	Topic
Week 1:	Jan 7	No Lab.
Week 2:	Jan 14	Chemical origin of the Earth.
Week 3:	Jan 21	Crater counting and relative age (Guest: Dr. Stooke, Geography).
Week 4:	Jan 28	Spectroscopy of asteroids and correlation to mineralogy (NIR).
Week 5:	Feb 4	Microscopy: mineralogy & textures of meteorites I.
Week 6:	Feb 11	Microscopy: mineralogy & textures of meteorites II.
**********	Conference Week – February 17-21	**********
Week 7:	Feb 25	Typing of meteorites (using microscopy). (Guest: Dr. Phil McCausland, Meteorite Curator)
Week 8:	Mar 4	Typing of meteorites (using microscopy) – continued.
Week 9:	Mar 11	Micro X-ray Diffraction of meteorites: Phase ID, olivine unit cell, strain index.
Week 10:	Mar 18	Flemming and Berger away (Lunar and Planetary Science Conference, Texas)
Week 11:	Mar 25	Micro X-ray Diffraction of meteorites – continued.
Week 12:	April 1	Seminar presentations.
Week 13:	April 8	Seminar presentations.

Evaluation

Marks:	Midterm Exam*+: (50 min)	February 13	20%
	Lab assignments: (5)	Due weekly (beginning of the next week's lab)	25%
	Lab project (4 weeks)	Due April 1	10%
	Final presentation	April 1 or 8	5%
	Participation:	(Attendance, class discussion, and seminar participation)	10%
	Final Exam*: (2 hr)	TBA	30%

* NOTE: Calculators will be allowed during tests and exams. No makeup midterm test will be given.
For students with a legitimate reason for not attending, this 20% will be added to the weight of the final exam.

Readings

Texts:
McSween, H. Y. (2000) *Meteorites and Their Parent Planets. 2nd Ed.* Cambridge University Press, UK
Norton, O. R. and Chitwood, L. A. (2008) *Field Guide to Meteors and Meteorites*, Springer. USA (useful laboratory guide)

Additional readings:
You will be responsible for additional readings, assigned in lectures. This material will be made available online.

Resource texts:
McSween, H. Y. and Huss, G. R. (2010) *Cosmochemistry.* Cambridge University Press, UK
Lauretta, D. S. and McSween, H. Y. Eds. (2006) *Meteorites and the Early Solar System II* (Taylor: QB755.M4854x 2006)
Lauretta, D. S. and Kilgore, M. (2005) *A Colour Atlas of Meteorites in Thin Section*, Southwest Meteorite Press, Payson, AZ
Hutchison, R. (2004) *Meteorites: A petrologic, chemical and isotopic synthesis.* Cambridge Planetary Science, UK
Papike, J. J. Ed. (1998) *Planetary Materials*, Reviews in Mineralogy Vol. 36: Mineralogical Society of America. Washington

Ethical Conduct: Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/handbook/appeals/scholoff.pdf.

Plagiarism: Students must write their assignments in their own words. Whenever you take an idea, or a passage from another author, you must acknowledge this both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence.

In case of medical illness:
If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately.
For further information please see: http://www.uwo.ca/univsec/handbook/appeals/medical.pdf

A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services.
The form can be found here: https://studentservices.uwo.ca/secure/medical_document.pdf

Accessibility Statement: Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.