Geos 692 – Fluvial Sedimentology (3 Credits)

Lectures: Tuesday, Thursday, 9:45-11:15 a.m. – REIC 237
Prerequisites: Graduate standing or permission of instructor

Instructor: Dr. Paul McCarthy
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Office Hours: Monday & Friday 9:00-10:30 a.m., or by appointment

Recommended supplementary reading:

There is no required text for this course. Students may find information in some of the following references helpful. This is NOT a required reading list.

Bridge, J.S., 2003. Rivers and Floodplains. Blackwell Science Ltd., London.

Brierly, G.J. and Fryirs, K.A., 2005. Geomorphology and River Management.Blackwell Science Ltd., London.

Knighton, D., 1998. Fluvial Forms and Processes: a new perspective. Oxford University Press, New York.

Miall, A.D., 1996. The Geology of Fluvial Deposits: sedimentary facies, basin analysis and petroleum geology. Springer-Verlag, Berlin.

Course description:

This is an advanced course in fluvial sedimentology focusing on an integrated examination of fluvial geomorphology, processes and sedimentary deposits at both local and basin-scales. The course emphasizes recognition of different fluvial styles in the rock record and the use of fluvial deposits for understanding basin evolution, paleoenvironmental changes, stratigraphic architecture and resource exploitation.

Course goals:

This is a lecture course designed to provide students with detailed knowledge of fluvial sedimentology as a geological tool for interpreting the rock record. By the end of the course, students will understand drainage networks and catchment processes, be aware of basic flow mechanics and mechanisms of sediment transport, understand elements of both channel and overbank environments and channel patterns, be aware of causes of channel changes through time, understand tectonic and climatic controls on fluvial systems, and recognize the significance of fluvial deposits for understanding basin evolution and for resource exploitation. Students will also explore an additional area of fluvial sedimentology in greater detail by completing a term paper.

Tentative Class Schedule:

Week 1: Drainage Basin - I

- Drainage Networks
- Drainage Density
- Channel Initiation
- Evolution of Drainage Networks

Week 2: Drainage Basin – II

- Catchment processes
- Catchment hydrology
- Catchment denudation
- Sediment yield and sediment budgets

Week of February 1 - Consultation with instructor concerning paper topic

Week 3: Fluvial processes

- Mechanics of flow
- Entrainment and erosion
- Sediment transport – dissolved, suspended, bedload
- Sediment deposition
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Week 4: Fluvial channels

- Bedforms & Bars
- Lithofacies
- Architectural elements within channels

Week 5: Overbank Environments

- Floodplain processes
- Facies, paleosols & fossils
- Architectural elements of the overbank environment

Week 6: Channel Pattern

- Adjustment of channel form
- Channel patterns
- Fluvial facies models
- Channel gradient and the longitudinal profile

Week 7: Stratigraphic Arctitecture of Fluvial Depositional Systems

- Channel belts
- Depositional Systems
- Basin fill complexes

March 10 - Mid-term examination

Week 8: Autogenic Controls on Fluvial Depositional Systems

- Avulsion
- Development of meander belts
- Alluvial stratigraphy models

Week 9: Tectonic Controls of Fluvial Sedimentation

Week 10: Fluvial Systems and Climate

April 5 – Completed draft of research paper due (including abstract & figures)

Week 11: Channel Changes through time

- Evidence and causes of change
- Philosophies of change

April 19 – Completed peer review of another student's research paper due

Week 12: Fluvial Sequence Stratigraphy

- Accommodation
- Systems Tracts
- Fluvial sequence models

Week 13: Fluvial Landforms

- Paleosols in aggradational systems
- Paleosols at unconformities
- Paleosols and sequence stratigraphy
- Sediment accumulation rates

Week 14: Fluvial Reservoirs

- Paleo-valley fields
- Sheet reservoirs
- Channel-and-bar reservoirs

May 6 – Revised term paper due
May 10 – 3:15 am – 5:15 pm - Final examination

Evaluation:

Students in the course will be evaluated on the basis of two examinations, some short presentations and a term project (if you have data you would like to work with) or paper (library research). The term project should be decided upon in consultation with the instructor. The term project or paper should focus on the solution of a clearly identified problem, and it should be written up in the format of a scientific research paper

or review paper to a quality that would be suitable for publication (although publication is not expected, nor required).

Students should meet with the instructor by the end of the first week of classes to discuss and determine a topic for the research project. A completed draft of the research paper is due one month before the end of classes. Each draft report will be collected and given to another student for peer review. Students will receive copies of their draft report with accompanying reviews from a student peer reviewer and the instructor. The final report should incorporate feedback from the draft review. Deadlines for the various stages of the final report are included in the tentative class schedule above. The term project forms the major component of the student's grade.

Several research papers will be provided for you to read, summarize and briefly present to the class (10 mins. max.) on selected topics in fluvial sedimentology.

Grading scheme:

Mid-term examination – 15%
Final examination – 15%
Presentations – 10%
Term paper – 60% broken down as follows:
- 30% - first draft
- 10% - peer review of other student's paper
- 60% - final draft of paper