Introduction:

*Sedimentology* is the scientific study of sedimentary rocks and of the processes by which they form [glossary of geology]. As a function of scope of observation, the broad field of clastic sedimentology studies processes that range from the formation of small-scale bedforms, with the emphasis on the hydrodynamics of sediment motion (sediment mechanics), to the formation and evolution through time of larger-scale depositional systems and depositional system associations. In fact, processes that operate over different spatial and temporal scales are interrelated. Their mutual relationship is emphasized when discussing any of the topics included in this course.

The field of sedimentology evolved rapidly within the last half century, with a general shift in emphasis from the study of *products* (e.g., lithological characteristics of sedimentary rocks) to the study of *processes* by which sedimentary rocks form. It is now known that sediment accumulation is governed by a combination of *autogenic processes* (driven by strictly local conditions, without interference by ‘external’ forcing; such processes require no change in the total energy and material input into a sedimentary system, but involve simply the redistribution of these elements within the system) and *allogenic processes* (driven by factors that are ‘external’ relative to the sedimentary system, e.g. tectonism, climate, or sea-level change). As reflecting local shifts in the balance between environmental energy and sediment supply, autogenic processes have a random nature and hence are difficult to predict at any scale of observation. In contrast, allogenic controls synchronize depositional processes across entire sedimentary basins, affording the prediction of facies relationships from the scale of individual depositional systems to entire sedimentary basin fills. Such models are particularly useful in the exploration for hydrocarbons, coal and mineral resources, as well as during subsequent production stages of field development.

This course integrates all modern concepts of process sedimentology into a coherent ‘package’ that accounts for all processes of sedimentary rock formation, from smaller to larger scales. The larger-scale ‘sequence stratigraphic’ framework of facies relationships is used as a template that allows one to see how smaller-scale processes and depositional elements fit into the bigger picture. The understanding of interrelated depositional processes that operate over various scales is a valuable asset for anyone working with sedimentary rocks, and it requires integration of multiple data sets (outcrop, core, well log, and seismic data), as well as the use of research techniques pertaining to the fields of geology, geophysics, and engineering.
Required textbook (available at the U of A Bookstore – SUB):


Recommended textbooks:


Course outline:

Week 1: **Introduction**
- lecture by instructor
- in-class exercises
- discussion: lecture material and exercises
- background reading: Chapter 1 of the required textbook

Week 2: **Clastic depositional systems; methods of study of sedimentary rocks**
- lecture by instructor
- in-class exercises
- discussion: lecture material and exercises
- background reading: Chapter 2 of the required textbook

Week 3: **Accommodation and shoreline shifts**
- lecture by instructor
- in-class exercises
- discussion: lecture material and exercises
- background reading: Chapter 3 of the required textbook

Week 4: **Types of contacts in the clastic sedimentary rock record**
- lecture by instructor
- in-class exercises
- discussion: lecture material and exercises
- background reading: Chapter 4 of the required textbook

Week 5: **Systems tracts: depositional system associations**
- lecture by instructor
- in-class exercises
- discussion: lecture material and exercises
- background reading: Chapter 5 of the required textbook
Week 6: **Sequence models**
- lecture by instructor
- in-class exercises
- discussion: lecture material and exercises
- background reading: Chapter 6 of the required textbook

Week 7: **Time attributes of stratigraphic surfaces**
- lecture by instructor
- in-class exercises
- discussion: lecture material and exercises
- background reading: Chapter 7 of the required textbook

Week 8: **Concept of hierarchy in the rock record**
- lecture by instructor
- in-class exercises
- discussion: lecture material and exercises
- background reading: Chapter 8 of the required textbook

Weeks 9, 10: **Student assignments 1: depositional systems, large scale**
- definition, subenvironments, morphology, rock record, modern analogues
- time limit: 40 minutes
- handouts should be limited to 5 pages of text + figures and references

Weeks 11, 12: **Student assignments 2: depositional systems, small scale**
- sedimentary textures, sedimentary structures and flow regimes in the context of each subenvironment
- time limit: 40 minutes
- handouts should be limited to 5 pages of text + figures and references

**Depositional systems:** 1. Fluvial systems; 2. Aeolian systems; 3. Estuarine systems; 4. Deltaic systems; 5. Shallow-water systems; 6. Deep-water systems.

**Course evaluation:**
1. In-class discussions: 10% of final mark
2. In-class presentations 1 (weeks 9, 10): 25% of final mark
3. In-class presentations 2 (weeks 11, 12): 25% of final mark
4. Final essay (deadline: 26 April 2008): 40% of final mark