EAS 462/562 – 2010, Winter Term (3-0-3):

Stratigraphy and Sedimentary Basins

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Office hours: contact instructor for appointment.

Lecture room and time: Tory Building, T 3-58; Tue, Thu: 8:00 – 9:20.

Course description:

The science of rock strata in a sequence stratigraphic framework; sequence stratigraphic models; classification and evolution of sedimentary basins; applications of sequence stratigraphy to depositional systems and tectonic settings.

Prerequisite: EAS 336. Not available to students with credit in EAS 330 [Faculty of Science]

Required textbook (available at the University of Alberta Bookstore, or online: http://www.elsevier.com/wps/find/bookdescription.cws_home/707658/description#description):


Recommended textbooks:


Course objectives:

This course is designed to improve the skills of using the method of sequence stratigraphy for petroleum, coal and mineral exploration and production. All concepts are illustrated with field examples of seismic, well-log, core, and outcrop data. In-class exercises emphasize the recognition of sequence stratigraphic surfaces and systems tracts on well-log cross-sections, seismic lines, and outcrop profiles. The points of agreement and difference between the various sequence stratigraphic approaches are discussed, and guidelines are provided for a standardized process-based workflow of sequence stratigraphic analysis. This enables the practitioner to eliminate nomenclatural and methodological confusions, and apply sequence stratigraphy effectively for facies predictions in exploration and production.
Lecture schedule:

• Basin analysis: definition
• Criteria for the classification of sedimentary basins
• Classification of sedimentary basins
• Inversion tectonics
• Examples of sedimentary basins on industry data
• Historical development of sequence stratigraphy
• Methods and workflow of sequence stratigraphic analysis
• Fundamental concepts of sequence stratigraphy
• Sequence stratigraphic surfaces
• Systems tracts
• Sequences and sequence models
• Time attributes of stratigraphic surfaces
• Hierarchy of sequences and sequence boundaries
• Applications to all depositional systems

Readings will be assigned from the required textbook.

NB: most sections of the course will be followed by in-class exercises presented by the instructor in order to reinforce the theoretical concepts.

Course evaluation:

1. Lab project: 30% of final mark.

  • Topic: case study of sequence stratigraphic interpretation
  • Approach:
    - independent research, flexible hours (3 hours per week are credited towards this project)
    - choose one case study, based on published outcrop, well-log or seismic data [NB: common sources of information include: research articles published in journal or books; AccuMap well-log data base; atlases of seismic lines; the Geological Atlas of the Western Canada Sedimentary Basin: http://www.ags.gov.ab.ca/publications/ATLAS_WWW/ATLAS.shtml]
  • Structure: your Lab Project should include 4 sections
    1. Introduction: indicate the source of information (i.e., cite the reference where the data come from); present the study area (show a map); present the stratigraphic objective (age of the unit under analysis; show a stratigraphic chart).
    2. Presentation of uninterpreted data: define the type of data available (e.g., sedimentologic, biostratigraphic, geophysical, etc.); indicate the depositional systems involved in your data set; present the uninterpreted data (e.g., outcrop sections, if you use outcrop data; one outcrop-based cross-section, if you use outcrop data; one well-log cross-section, if you use well-log data; one seismic line, if you use seismic data). Indicate the location of your outcrops, cross-section or seismic line on the map of the study area. The horizontal and vertical scales of your cross-section or seismic line may vary with the type of data that you are using. A good scale is one that permits a good visualization of the data on a tabloid-size (11 x 17 inches) paper.
    3. Presentation of interpreted data: show the depositional systems, sequence stratigraphic surfaces and systems tracts on your cross section or seismic line. Your interpretation may or may not
agree with previously published interpretations. You must be comfortable with your interpretation and be able to defend it.

4. Discussion: explain why your interpretation provides the best working model; discuss the potential pitfalls of your interpretation.

NB: examples of such case studies will be presented by instructor in class throughout the course.

• Submit: one PPT file (include a figure caption in the footnote of each slide; every piece of information that is not your original work must be credited to the original source). There is no limit to the number of slides which you can include in your PPT file.
• Deadline: 12 April 2010 (last day of classes).

NB: do not leave this assignment for the last days of the term. If time permits (depending on enrollment figures), you may be asked to make a 15-minute oral presentation of this assignment anytime starting with 1 April 2010, even though your project may be incomplete. This is to ensure that (1) you are on the right track with your project; and (2) you develop the skill of making oral presentations.

2. Term Assignment: 30% of final mark.
• Topic: applications of sequence stratigraphy to tectonic settings (1)
• Purpose: to prepare you for the Final Essay (see below)
• Approach:
  - choose *one tectonic setting* from the list below
  - in case two or more students have selected the same tectonic setting, the case studies must be different
• Structure: your Term Assignment should include 3 sections
  1. Introduction: define the type of sedimentary basin that you have selected; present the main characteristics of that particular tectonic setting: physiography, scale, subsidence mechanisms, depositional systems and sediment supply.
  2. Case study: present *one case study* that illustrates the application of sequence stratigraphy to that particular tectonic setting.
  3. Discussion: indicate reasons as to why sequence stratigraphy may apply differently to your chosen tectonic setting relative to any other type of tectonic setting.

• Submit: one PPT file (include a figure caption in the footnote of each slide; every piece of information that is not your original work must be credited to the original source). There is no limit to the number of slides which you can include in your PPT file.
• Deadline: 12 April 2010 (last day of classes).

3. Final Assignment: 40% of final mark.
• Topic: applications of sequence stratigraphy to tectonic settings (2)
• Approach:
  - choose *one tectonic setting* from the list below (same as the one selected for the Term Assignment)
  - in case two or more students have selected the same tectonic setting, the case studies must be different
• Structure: your Final Assignment should include 4 sections
1. Introduction: define the type of sedimentary basin that you have selected; present the main characteristics of that particular tectonic setting: physiography, scale, subsidence mechanisms, depositional systems and sediment supply.

2. Case studies: present three case studies that illustrate the application of sequence stratigraphy to that particular tectonic setting.

3. Sequence stratigraphic model: based on the case studies presented, summarize the sequence stratigraphic architecture (i.e., define a “model”) that captures the typical “signature” of that particular tectonic setting (e.g., typical geometries; relative development of systems tracts; what systems tracts, depositional systems and sequence stratigraphic surfaces tend to be most prominent within that tectonic setting, etc.).

4. Discussion: indicate reasons as to why sequence stratigraphy may apply differently to your chosen tectonic setting relative to any other type of tectonic setting.

• Submit: one PPT file (include a figure caption in the footnote of each slide; every piece of information that is not your original work must be credited to the original source). There is no limit to the number of slides which you can include in your PPT file.
• Deadline: 29 April 2010 (last day of examinations).

Feedback on your progress, as well as guidance, will be provided throughout the term.

Tectonic settings:

1. Intracratonic sag basins
2. Grabens
3. Rift basins
4. Divergent continental margins: continental shelves
5. Divergent continental margins: continental slopes
6. Divergent continental margins: basin floors
7. Convergent margins: deep-sea trenches and accretionary prisms
8. Convergent margins: forearc basins
9. Convergent margins: backarc basins
10. Convergent margins: interarc basins
11. Convergent margins: intra-arc basins
12. Convergent margins: retroarc forelands
13. Convergent margins: proarc forelands
14. Convergent margins: intramontane basins
15. Transform margins: strike-slip basins

Teaching assistant:

Ryan King <mrking@ualberta.ca>, Tory 3-9.
University regulations:

DEFERRED exam policy:

These are NOT automatically granted and documentation is required for those applying for or requesting a deferral. Students who are granted deferral for the mid-term exam (if applicable) or term work will have that percentage transferred to the final exam (or final essay, as applicable). Students granted a deferred final exam (or final essay, as applicable) must make arrangements with the instructor. You must apply to your department for deferred final exams (or final essays, as applicable).

Deferral of term work is a privilege and not a right. There is no guarantee that a deferral will be granted. Misrepresentation of Facts to gain a deferral is a serious breach of the Code of Student Behaviour.

RECORDING of lectures:

Recording is permitted only with the prior written consent of the professor or if recording is part of an approved accommodation plan. This is at the instructor’s discretion.

If an instructor grants permission, the default should be that the recording is solely for the personal use of the student. If a lecture is to be recorded, the instructor must notify the class that this is taking place. If the recorded lecture is intended for the usage beyond individual study, the person making the recording needs to obtain the permission of all other individuals that appear in the recording. This should be verified beforehand by enquiring with the University’s Information and Privacy Office.

SPECIALIZED SUPPORT AND DISABILITY SERVICES:

Students who require accommodations in this course due to a disability affecting motion, vision, hearing, learning, or mental or physical health are advised to discuss their needs with Specialized Support and Disability Services, 2-800 Students’ Union Building, 492-3381 (phone) or 492-7269 (TTY). Please ensure that the required forms for exams are submitted to the instructor several days before the date of the midterms or final (where applicable).

GFC POLICY ON COURSE OUTLINES:

Policy about course outlines can be found in Section 23.4(2) of the University Calendar.

ACADEMIC STANDARDS:

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.ualberta.ca/secretariat/appeals.htm) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offense. Academic dishonesty is a serious offense and can result in suspension or expulsion from the University.

A copy of the ‘Don’t Cheatsheet’ is available online at www.uofaweb.ualberta.ca/secretariat/