

## Geology 9564a, Basin Analysis & Sequence Stratigraphy

**Instructor:** Dr. A. G. Plint. BGS Rm 1072, [gplint@uwo.ca](mailto:gplint@uwo.ca), 519-661-3179.

**Time, Place TBA.** Weekly class is 3 hours, combined lecture and lab, with a break. Time and classroom to be determined depending upon participant's schedules.

### Prerequisites.

This is a graduate level only course, and pre-supposes a working knowledge of sedimentary processes, depositional environments and facies; plate tectonics, structural geology and a little geophysics.

### Outline

Basin Analysis is many things to many people! However, most workers would now agree that Basin Analysis is fundamentally concerned with i) *Subsidence History*, and ii) *Paleogeographic Evolution* of a sedimentary basin. These aspects are investigated primarily through the disciplines of stratigraphy, sedimentology, structural geology and geophysics.

Lectures In order to understand the *fill* of a sedimentary basin, it is first important to review the basic physical properties of the lithosphere, and the mechanisms by which large portions of the lithosphere are made to subside in order that sediments may accumulate. In view of this, the first part of the course will consider **Lithospheric Rheology**, followed by a discussion of the **Main Basin Types** in their plate-tectonic context.

The second theme of the course will concern **Stratigraphy**. In this section, I will look at some of the important ideas in this field, including Depositional Systems and Systems Tracts, Chronostratigraphic methods, Seismic Stratigraphy, Sequence Stratigraphy and Stratigraphic Cyclicity. These aspects are important because they allow the basin analyst to define a *time stratigraphy* for the basin. This is an essential prerequisite to any sort of paleogeographic analysis, and is also critical in analysis of relative sea level changes. Key slides from lectures will be posted to the class website before each class.

Lab Exercises We will examine a number of practical problems during the labs. I will utilise a number of classic seismic sections in order for students to determine for themselves, various basin-forming mechanisms. We will also undertake one or more sequence stratigraphic exercises where the basic character of key stratigraphic surfaces, systems tracts, and chronostratigraphy will be explored.

### Evaluation

Students can elect whether to be evaluated entirely on the basis of a Term Paper and an Oral Presentation (=100% course mark), or whether to be evaluated on a Term Paper and Oral Presentation (60%) **and** a Final Exam (40%). Lab exercises are not marked, but each will be discussed in class.

**Term Paper.** Each student in the course will choose, or be assigned, a topic to investigate, based on published literature. Results are to be presented in the format of a scientific review paper (e.g. *Journal of Sedimentary Research*), and each paper should *not exceed* 15 typed, double-spaced pages, including a 300 word Abstract; Figures and References do not count in the 15 page limit. Each paper will be reviewed and edited by the instructor, and each student will be invited to discuss comments on their essay in a personal tutorial session. A summary of your findings will be presented to the class in an approximately 15 minute talk. Papers will be submitted as hardcopy, and also as electronic pdf format for possible checking by *Turnitin* software (see 'Academic Offences' below).

## **Learning Outcomes:**

Upon successful completion of this course, students will be able to:

1. Explain the genetic mechanisms, history, and characteristic sedimentary fill of the main types of sedimentary basin.
2. Apply theoretical knowledge to interpret a variety of seismic sections through sedimentary basins in order to make reasoned deductions about basin history, the character of the sedimentary fill, and assess the possible location of hydrocarbon reserves.
3. Apply first principles to create the key elements of a depositional sedimentary sequence; decipher the origin and significance of key bounding surfaces; discover the predictive power of the sequence stratigraphic model.
4. Create a chronostratigraphic chart as a means to visualize the relationships between sedimentation, time, and space.
5. Synthesise the literature in order to prepare a formal paper summarizing current interpretations of a selected topic in basin analysis or sequence stratigraphy, and explain discoveries by means of an oral presentation.

## **Academic Offences:**

“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> .”

“All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com ( <http://www.turnitin.com> ).”

## **Absence from Exams**

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>

## **Accommodation due to Illness**

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](https://studentservices.uwo.ca/secure/medical_document.pdf)

**Accessibility** 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.

**Books** There are some good summary texts available, and I recommend these as a good basic source of additional references when researching your topics. The first two listed below are probably the best. *Tectonics of Sedimentary Basins*, edited by Cathy J. Busby & Raymond V. Ingersoll. 1995, Blackwell Science,

579 p. QE571.T355

*Principles of Sedimentary Basin Analysis* (2nd Ed.), Andrew Miall, 1990. Springer-Verlag, 669 p.

QE471.M44. By way of introduction to the field of basin analysis, I strongly recommend reading chapter 1 of this book.

*The Geology of Stratigraphic Sequences*, Andrew Miall, 2010. Springer Verlag, 522 p. QE651.M46.

*Basin Analysis - principles & applications*, P.A. Allen & J.R. Allen. 2005, 2<sup>nd</sup> Ed.. Blackwell Science, 549 p. QE571.A45

*Sedimentary Basins, evolution, facies and sediment budget*. Gerhard Einsele, 1992. Springer-Verlag, 628 p. QE751.E36.

*New Perspectives in Basin Analysis*, edited by Karen Kleinspehn & Chris Paola. 1988 Springer-Verlag, 453 p. QE571.N39. (This is not so much a text book as a collection of papers on various aspects of basin analysis).

*Sedimentary Environments and Facies*, edited by Harold G. Reading, 2<sup>nd</sup> edition, Blackwell Scientific Publications, 615 p. This book contains a useful chapter (14) on 'Sedimentation and Tectonics' (unfortunately dropped from the 3<sup>rd</sup> (1996) edition of this classic book). QE571

*Tectonics of sedimentary basins: Recent advances*, edited by Cathy Busby and Antonio Azor, 2012, Wiley-Blackwell, 647 pp. (Online book available in library).

*Basin Analysis, principles and applications* (2<sup>nd</sup> Ed.). P.A. Allen and J.R. Allen, 2005. Blackwell Publishing, 549 p. QE571.A54.