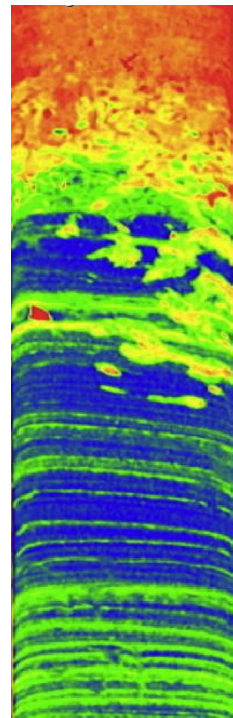
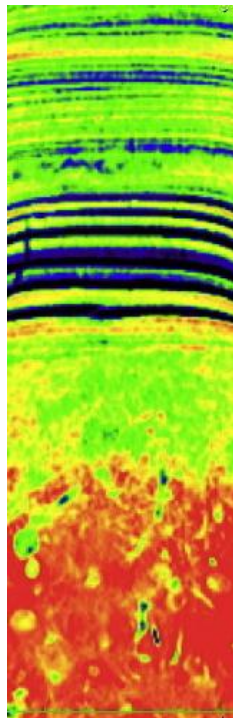




FACULTY OF SCIENCE

DEPARTMENT OF EARTH AND PLANETARY SCIENCES



# **GEOS126 MARINE GEOSCIENCE**

**Semester 2 2011**

Cover photo: Scans of sediment drill core from the Bering Sea IODP Leg 323 showing laminated sediment and bioturbated sediment. The extent of bioturbation reflects oxygenation of bottom waters.

## **DEPARTMENT OF EARTH AND PLANETARY SCIENCES**

### **GEOS126 MARINE GEOSCIENCE**

#### **INTRODUCTION**

Ocean basins are constantly changing. Over the past 200 million years, the Atlantic Ocean has been gradually opening and the Pacific Ocean has been closing. The Mediterranean Sea is destined to become a mountain range and the eastern part of Africa may be split by the birth of a new ocean. The driving force for these changes is plate tectonics which determines not only the shape of the ocean, but also the ocean bottom topography. Changes in the configuration of oceans has profound effects on oceanic circulation, which in turn influences the distribution of sediments on the ocean floor and margins, and on the distribution and evolution of marine life. Moreover, both deep and shallow circulation patterns have been intimately linked to climatic change through time

This unit introduces you to the marine environment through the study of past and present oceans. From the perspective of marine geoscience we will consider aspects of the geological history and dynamics of the oceans, geophysical and remote sensing techniques for probing the ocean's depths and the contribution of deep-sea drilling to our understanding of how ocean basins are born, grow and eventually die. We will examine patterns of erosion, transport and deposition of sediments and the relationship to plate tectonics. The unit also investigates marine communities through time and their contribution to evolution of life. Finally we will explore the relationship between oceans, climatic change and plate tectonics throughout the evolution of Planet Earth.

This unit provides background for further studies in marine science, earth and environmental science, palaeontology, biology, chemistry and resource management.

#### **KEY LEARNING OUTCOMES**

The key learning outcomes for this unit are:

1. understanding of marine geoscience issues; these are organised in three modules:
  - Shifting Sands through Time
  - Birth and Death of Ocean Basins
  - Oceans, Climate and Plate Tectonics
2. understanding scientific methodology
3. competence in accessing, using and synthesising appropriate information;
4. application of knowledge to solving problems and evaluating ideas and information; and
5. capacity to present ideas clearly with supporting evidence.

## UNIT OUTLINE

The unit is divided into three modules, with each module focusing on a different aspect of marine geoscience. The main ideas and objectives for the three modules are listed below.

### ***Unit Introduction (2 weeks):***

- describe the tools that are used to determine what is under the oceans and how the ocean basins are constructed; these tools include deep-sea drilling, geophysical methods and remote sensing;
- appreciate the range of resources that occur in the ocean crust or on the ocean bottoms, how they are formed, and the difficulties that must be overcome to detect and use them.

### ***Module 1: Shifting Sands through Time (4 weeks)***

- discern that erosion of the land supplies most of the detritus that covers the continental shelf and slope;
- identify the features and rates of coastal erosion;
- examine siliciclastic deposition in oceans, with particular emphasis on coastal estuarine, shallow water shelf and deep water fan sedimentation;
- analyse erosion, transport and depositional processes on the continental shelf, slope and rise;
- describe the geophysical tools used for imaging and logging the sediments;
- interpret the response of recent marine organisms and ecosystems to environmental factors;
- appreciate that distribution of marine fossils is influenced by environmental factors during the lifetime of the organism and by sediment transport and other factors after death. This helps us interpret past environments.

### ***Module 2: Birth and Death of Ocean Basins (3 weeks)***

- distinguish the factors that determine ocean floor bathymetry and relief;
- understand how ocean basins have changed their configurations through time due to the operation of plate tectonics;
- recognise that present ocean basins have not always existed, and that the evidence for the youth of present oceans lies in the ocean floor basement and the sediments;
- appreciate the role of plate tectonics in the birth and demise of oceans.

### ***Module 3: Oceans, climate and plate tectonics (4 weeks)***

- comprehend that ocean waters have not always had exactly the same composition as at present;
- establish that deep and shallow circulation patterns of the ocean are influenced by the shape and configuration of the ocean basins;
- understand the link between changes in the ocean basins brought about by plate tectonics and resultant changes in sea level, ocean circulation etc.; e.g. periods of fast and slow spreading;

- appreciate that periods of glaciation and growth of ice caps, as well as other factors have caused changes in ocean circulation, and composition;
- demonstrate that changes in ancient ocean waters can be detected by observing patterns of sediment deposition; e.g. salt deposits, black shales;
- understand that marine environments have always been an important part of the biosphere and have played a significant part in the evolution of life on earth;
- examine the changes in shallow marine fauna of Australia through time;
- perceive that the large-scale distribution of marine fossils can be explained to a large extent by palaeogeography of the oceans and continents;
- show how changes in ancient ocean waters can be detected by changes in the isotopic composition of shells, ice, and so on.

#### **STAFF:**

The unit convenors are:

Dr. Sandra Piazzolo (9850 4407; email: [sandra.piazzolo@mq.edu.au](mailto:sandra.piazzolo@mq.edu.au)) E7A Rm 425

Dr Dick Flood (9850 8370; e-mail: [richard.flood@mq.edu.au](mailto:richard.flood@mq.edu.au)) E7A Rm 508

#### **UNIT ORGANISATION**

##### **Credit Points: 3**

Each week there will be a one-hour lecture that gives a broad overview of the topic, provides background information, introduces new ideas and integrates concepts that are covered in the workshops and research projects.

The workshops include two types of activities. The first are tutorial style discussions or laboratory-based practicals, and the second are research projects.

There will be three research projects, one for each module. These projects will be extended enquiries into real geo-scientific problems, usually extending over 2 – 3 weeks. These problems are different to the ones that you would typically find in textbooks, and more closely resemble the investigations that scientists face in the real world, with many interacting factors and a number of possible solutions.

You will be working in small teams for each research project, both in attempting to solve the problem and to produce a final report. Each member of the team will be expected to do substantial research outside of class time (e.g. library and/or web-based literature search). Remember that for each credit point you are expected to undertake 4 hours of work per week. In GEOS126, your class contact time is only 3 hours per week, so at least a further 3 hours per week of reading, research or working with other students will be necessary to successfully complete the tasks allocated.

Each of the research projects will allow you to explore the ideas in depth and will provide an effective and, we hope, enjoyable method of learning. There is also the added benefit of providing you with opportunities to develop your abilities in problem-solving, team work, communication, accessing and evaluating information and in using scientific approaches to solve problems.

**Lecture:** one-hour lecture Monday 10-11 in room E7B 263  
a repeat of this lecture is held on Wednesday 10-11, in room E7B T2

**Workshops:** see your timetable about workshop times and locations

## **SCHEDULE OF WORK**

At the end of this booklet is a table with lecture and workshop titles.

### **Field Trip:**

On Saturday, August 13 we have planned a field trip/boat cruise around Port Hacking to examine and collect sediments from a variety of marine and estuarine environments. You will need to get yourself to Gunnamatta Bay (near Cronulla) in time to catch the boat for the cruise.

The estimated cost of the trip is \$20.00 per student.

If you are unable to attend the field trip you will be expected to complete another research activity.

## **GRADUATE CAPABILITIES**

Students will enter a globalizing world of major environmental change and resource constraints, of scientific and technological advance and ethical challenge, of continuing political instability and possible international conflicts, of unlimited creativity and increasing social surveillance. To prepare students for life after university, various graduate capabilities are developed through the curriculum. These capabilities are described below.

No.	Capability	Brief Description
1	<i>Discipline Specific Knowledge and Skills</i>	Graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession.
2	<i>Critical, Analytical and Integrative Thinking</i>	Graduates are to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments.
3	<i>Problem Solving and Research Capability</i>	Graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge.
4	<i>Creative and Innovative</i>	Graduates will be capable of creative thinking and of creating knowledge.
5	<i>Effective Communication</i>	Students develop the ability to communicate and convey their views in forms effective with different audiences.
6	<i>Engaged and Ethical Local and Global citizens</i>	Graduates will have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy.
7	<i>Socially and Environmentally Active and Responsible</i>	Graduates to be aware of and have respect for self and others.
8	<i>Capable of Professional and Personal Judgement and Initiative</i>	Graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement.
9	<i>Commitment to Continuous Learning</i>	Graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake.

## ASSESSMENT OF THE UNIT

### Assessment tasks:

Task	Weight	Linked learning outcome	Linked graduate capability
Research projects	36%	1, 2, 3, 4, 5	1, 2, 3, 4, 5, 7, 8, 9
Tutor's mark	5%	1, 2, 3, 4, 5	1, 2, 3, 4, 5, 6, 7, 8, 9
Online Quizzes	9%	1, 2, 3, 5	1, 2, 3, 5
Final examination	50%	1,2,3,5	1,2,3,5

### **Research projects:**

For each project you will hand in one part that is a combined effort from the group and an individual component. The individual component will be a one or two page written report (plus diagrams, maps and references), which will concentrate on the synthesis of the ideas and conclusions. You will be given specific details of what is expected for both the group and individual components when you begin each research project.

### **Tutor's mark:**

Each student will be awarded a mark for their performance in class. Consideration will be given to your level of preparation for class and team discussions; your reliability as a member of a team; your contribution to team and class discussions and activities. Particular attention will be given to members of the teams who show initiative, creative problem-solving strategies and who diligently complete the tasks.

### **Quizzes:**

The weekly quiz will begin in week 2 and will be completed and marked online. The quiz will examine the lecture and practical topics of the previous week as well as the research projects.

### **Final examination:**

The final exam will cover material from the lectures, text book readings, workshops and research projects. Questions will draw on information and ideas from different modules to give an integrated view of the unit. The exam will include questions that ask you to apply your knowledge to interpret and solve problems about marine geoscience.

## **DATES FOR SUBMISSION OF ASSESSMENT TASKS**

Research project reports are due to be handed in at the beginning of the tutorial in the week following completion of the project.

Report for Research project 1 is due in week 5 (week beginning August 29)

Report for Research project 2 is due in week 9 (week beginning October 12)

Report for Research project 3 is due in week 13 (week beginning November 7)

### **Feedback on assessment tasks:**

Feedback on assessment tasks is given in this unit in the following ways:

1. Our primary mode of assessment feedback: the assessment marker will present overall feedback to the class, at either a lecture, tutorial or practical class, on what aspects of the assessment task were done best and where improvement is needed in general.

2. Students are strongly encouraged to seek further feedback (at the time it is given or by making an appointment with the assessment marker) if they are unsure of any aspect of the feedback or if they want further feedback.
3. We provide you with a checklist of what is asked in the assessment task and a breakdown of the marks awarded for each component. Scoring full marks for a given component indicates that you did exceptionally well. Alternatively, scoring poorly in a component strongly suggests it required further work.
4. In the instance of scoring very poorly overall, you will be provided with written feedback on the assessment task indicating where you could improve.

### **Lateness of assignments and reports:**

Marks will be deducted for assignments and reports that are late at the rate of 10% per day, unless accompanied by a medical certificate. In other exceptional circumstances you should contact your tutor **before** the due date.

### **Queries and appeals**

In the first instance, contact your tutor, or Dr Dadd if there are any questions about the assessment tasks themselves, or about the comments and grades that you receive for your assignments or reports. You are permitted to appeal against your final grade in any of your units. Before initiating an appeal, discuss your unit grade fully with the Unit convenor. More details of the Faculty of Science's appeals procedures are available from the Science Centre, E7A ground floor (9850 8418).

### **Desired Standards**

<b>Grade</b>	<b>Standard Required</b>
High Distinction	Demonstrates an extensive knowledge and understanding of the concepts of the course.
Distinction	Demonstrates a thorough knowledge and understanding of the concepts of the course.
Credit	Demonstrates a sound knowledge and understanding of the concepts of the course.
Pass	Demonstrates a basic knowledge and understanding of the concepts of the course.
Fail	Demonstrates a poor knowledge and understanding of the concepts of the course.

## **ACADEMIC HONESTY AND PLAGIARISM**

Plagiarism involves using the work of another person and presenting it as one's own. If you use the work of another person without clearly stating or acknowledging the source, you are falsely claiming that material as your own work and committing an act of **PLAGIARISM**. This is a very serious violation of good practice and an offence for which you will be penalised. You should read the University's policies and procedures on plagiarism. These can be found at:

<http://www.student.mq.edu.au/plagiarism/>

The policies and procedures explain what plagiarism is, how to avoid it, the procedures taken in cases of suspected plagiarism, and the penalties if you are found

guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

As such, all assignments must have a signed “Faculty of Science” (FoS) assignment cover sheet attached. These sheets are available from the Science centre or from the FoS WEB page.

## **11. University Policies**

Macquarie is developing a number of policies in the area of learning and teaching. Approved policies and associated guidelines and procedures can be found at Policy Central: <http://www.mq.edu.au/policy/>. There you will find the University’s policy and associated procedures on assessment, Special Consideration and grade appeal.

## **INFORMATION SOURCES**

### **Recommended Reading/Relevant References**

The recommended text is:

Merali, Z. and Skinner, B. J. 2009. *Visualizing Earth Science*  
John Wiley and Sons Inc. ISBN-13: 978-0471-74705-5

A number of Oceanography texts could also be referred to. Suitable texts are (copies held in library reserve):

Garrison, T., 2005. *Oceanography: An invitation to Marine Science, 5th edition*.  
Wadsworth, Inc. Belmont California. ISBN 0-534-53082

Kershaw, S., 2000. *Oceanography: An Earth Science Perspective*.  
Stanley Thornes Publishers. ISBN 0-7487-5442-3

### **Web Access**

Further information on this unit can be accessed at <http://learn.mq.edu.au>

## **EVALUATION OF THE UNIT**

We are interested in your ideas about how the unit is progressing and how it can be improved. At certain points during the semester, you may be invited to fill out a brief survey (1 page) to give us some feedback on how you find the unit content and presentation methods. There will also be opportunities at the end of the unit to give an overall impression. If you have any particular comments (good and bad) or ideas on how to make the unit better please let your tutor know!!

2011 dates	<b>Lecture Topics</b> Monday TBA; Wednesday TBA	<b>Lecture by</b>	<b>Workshop Topics</b>
Week 1- Aug 1	Introduction – why study marine geoscience?	Dick Flood	Mining the Ocean Floor
Week 2 – Aug 8	Plate tectonics – the birth and death of ocean basins	Dick Flood	Research Project 1 – Shifting sands of Port Hacking
<b>Field trip</b> Sat. Aug 13			Boat cruise on Port Hacking
Week 3 – Aug 15	From Mountains to the Sea: erosion, transport and deposition of sediments	Dick Flood	Research Project 1 (cont) – Shifting sands of Port Hacking
Week 4 – Aug. 22	Sedimentation on the continental shelf, slope and rise	Kelsie Dadd	Research Project 1 (cont) – Shifting sands of Port Hacking
Week 5 – Aug. 29	Marine biogenic sediments	Simon George	Marine Sedimentary Rocks
Week 6 – Sept. 5	Geophysics: seeing through the ocean floor	Mark Lackie	Research Project 2 – Exploring Ocean Basins – Arctic Ocean
Week 7 – Sept. 12	Remote sensing	Mark Lackie	Research Project 2 (cont) – Exploring Ocean Basins
	<b>Break</b> Sept 19-Sept 28		
Week 8 – Oct. 4 (no Monday Lect.)	Reconstructing past continents using marine fossils	James Valentine	Research Project 2 (cont) – Exploring Ocean Basins
Week 9 – Oct. 10	The briny deep – oceanic circulation patterns, past and present	Kelsie Dadd	Sediment accumulation rates
Week 10 - Oct. 17	Oceans, climate and plate tectonics	Kelsie Dadd	Research Project 3 – Icy Tales of the Antarctic
Week 11 – Oct. 24	Palaeontology and the Australian polar wander curve	Simon George	Research Project 3 (cont) - Icy Tales of the Antarctic
Week 12 – Oct. 31	Tales of ancient seas, climates and isotopes	Dick Flood	Research Project 3 (cont) - Icy Tales of the Antarctic
Week 13 – Nov. 7	Integrated Ocean Drilling Programme and marine geoscience research	Kelsie	Hand in Research Project 3 Wrap-up discussion.

Report for Research project 1 is due in week 5 (week beginning August 29)

Report for Research project 2 is due in week 9 (week beginning October 12)

Report for Research project 3 is due in week 13 (week beginning November 7)





