



# GEOS306

## Exploration and Environmental Geophysics II

S2 Day 2016

*Dept of Earth and Planetary Sciences*

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#### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

Unit convenor and teaching staff

Unit Convenor

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Lecturer

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Credit points

3

Prerequisites

GEOS305

Corequisites

Co-badged status

Unit description

This unit further explores the application of geophysical techniques from exploration for minerals to environmental, engineering and ground water problems. This unit builds on the foundation work covered in GEOS305, incorporating case history studies to further illustrate the application of geophysical methods. Practical work includes laboratory exercises in the reduction, plotting and interpretation of geophysical data. The field excursion gives students an appreciation of the practical application of geophysics, highlighting the advantages and limitations of the techniques studied during the unit.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

- understanding of the basic concepts of exploration and environmental geophysics
- gaining experience in operating geophysical equipment
- understanding scientific methodology

competence in accessing, using and synthesising appropriate information  
application of knowledge to solving problems and evaluating ideas and information  
capacity to present ideas clearly with supporting evidence

## General Assessment Information

### EXTENSIONS AND PENALTIES:

Whenever possible requests for an extension should be submitted prior to an assignment's due date. Late assignments will be date stamped and a penalty of 10% initially and then 5% per day will be deducted from the total mark.

## Assessment Tasks

Name	Weighting	Due
<u>Oral Presentation</u>	10%	see schedule
<u>Assignment II</u>	10%	Week 7
<u>Assignment I</u>	15%	Week 5
<u>Field Report</u>	30%	Week 13
<u>Exam</u>	35%	exam period

### Oral Presentation

Due: **see schedule**

Weighting: **10%**

Each student has to select a topic relevant to the unit on which a 10-15 minute long **oral presentation** must be given during the class hours. A selection of topics is given at the beginning of the unit

On successful completion you will be able to:

- competence in accessing, using and synthesising appropriate information
- capacity to present ideas clearly with supporting evidence

### Assignment II

Due: **Week 7**

Weighting: **10%**

Learn about and build geophysical loggers.

On successful completion you will be able to:

- understanding of the basic concepts of exploration and environmental geophysics
- understanding scientific methodology
- competence in accessing, using and synthesising appropriate information
- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## Assignment I

Due: **Week 5**

Weighting: **15%**

It will consist of questions relating to the topics covered in the first part of the semester and will include questions on both the theoretical and practical aspects of the unit material.

On successful completion you will be able to:

- gaining experience in operating geophysical equipment
- understanding scientific methodology
- application of knowledge to solving problems and evaluating ideas and information

## Field Report

Due: **Week 13**

Weighting: **30%**

An individual comprehensive field report is to be presented by each student, and submitted for assessment.

On successful completion you will be able to:

- understanding of the basic concepts of exploration and environmental geophysics
- gaining experience in operating geophysical equipment
- understanding scientific methodology
- competence in accessing, using and synthesising appropriate information
- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## Exam

Due: **exam period**

Weighting: **35%**

There will be a **final two-hour examination** held during the examination period in November/December. It will consist of a choice of questions to be answered in essay style.

On successful completion you will be able to:

- understanding of the basic concepts of exploration and environmental geophysics
- understanding scientific methodology
- competence in accessing, using and synthesising appropriate information
- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## Delivery and Resources

### Textbook

There is no compulsory textbook for this unit, but I recommend that you get a copy of “*An Introduction to Applied and Environmental Geophysics*” by Reynolds or “*An Introduction to Geophysical Exploration*” by Kearey *et al* as they look at the material at an appropriate level. As well, “*Geophysics for the Mineral Exploration Geoscientist*” by Dentith and Mudge is also worthwhile. If you already have one of the following books then that should be sufficient. All the books listed below give a good grounding in geophysics, just with a different focus

Burger, H.R., *Exploration Geophysics of the Shallow Subsurface*, Prentice-Hall, 1992. [TN269.B86]

Dentith M. and Mudge S.T., *Geophysics for the Mineral Exploration Geoscientist*, Cambridge University Press, 2014.

Gunn, P., *AGSO Journal of Australian Geology and Geophysics 17*, 1997. [QE340.A7]

Isles D.J. and Rankin L.R., *Geological Interpretation of Aeromagnetic Data*, ASEG, 2013 **e-book**

Kearey, P., Brooks, M. and Hill, I., *An Introduction to Geophysical Exploration, 3rd Edition*, Blackwell Scientific Publications, 2002. [TN269.K36/2002]

Lowrie, W., *Fundamentals of Geophysics*, Cambridge University Press, 1997. [QC806.L67/1997]

Mussett A.E. and Khan M.A., *Looking into the Earth*, Cambridge, 2000. [QE501.M87/2000]

Parasnis, D.S., *Principles of Applied Geophysics*, 5th Edition, Chapman and Hall, 1997. [TN269.P32]

Reynolds, J.M., *An Introduction to Applied and Environmental Geophysics*, John Wiley & Sons, 1997. [QC808.5.R49]

Reynolds, J.M., *An Introduction to Applied and Environmental Geophysics, 2<sup>nd</sup> Edition*, Wiley-Blackwell, 2011. [QC808.5.R49 2011]

Sharma, P.V., *Environmental and Engineering Geophysics*, Cambridge University Press, 1997. [TA705.S515]

Telford, W.N., Geldart, L.P., and Sheriff, R.E., *Applied Geophysics*, 2nd Edition, Cambridge

University Press, 1990. [TN269.T44]

Ward, S.H. (editor), *Geotechnical and Environmental Geophysics*, Vol. I-III, Society of Exploration Geophysicists, Tulsa, 1990. [TA705.G426]

The unit also has a WEB site which can be found through the iLearn WEBSITE at <https://ilearn.mq.edu.au/login/MQ/> .

Information for students about access to online units is available at

<https://ilearn.mq.edu.au/login/MQ/>

## Referencing

It is important that you understand how to correctly reference the information you do use, as often you will want to legitimately quote material or ideas from other sources. Information obtained from any source, including the Internet, is covered by copyright law. You must acknowledge any source that you refer to in your assignment, both within the text of your assignment, and at the end of it (by including a list of references). Referencing your sources also enables the reader to view your sources and follow your essay. Academic conventions and copyright law require that you acknowledge when you use the ideas of others. In most cases, this means stating which book or journal article is the source of an idea or quotation.

There are two aspects to learn: in-text references and a list of references cited. Please note that for the assignments, we insist that you reference using in-text references, with a reference list at the end (ie, not with footnotes). This is a common way to do it in many areas of science (but not all!), and it reminds you and indicates to the reader what the source is and how old it is. Please use the Harvard Style of referencing.

There is much information on in-text references and referencing of print and non-print sources available at:

<http://libguides.mq.edu.au/content.php?pid=459099&sid=3778407>

<http://libguides.mq.edu.au/content.php?pid=459099&sid=3759396>

### *How to cite references within the text of an assignment:*

These are also called in-text references. When you use another's ideas you should immediately acknowledge your sources, including in figure or table captions. Always give the surname of the author and the date of publication. Use the author-date method of citation for quotations and paraphrasing. Note spelling of et al. (used when 3 or more authors; please remember the fullstop). Note that the in text refs don't have author initials.

**Direct quote:** Brown et al. (1990, p. 12) conclude that 'the depth to the Moho under the oceans is less than under the continents'. Note that for a direct quote the page must be cited.

**General acknowledgement of the source of information:** “As explained by Schmidt and Lackie (2014), the Q-Meter is.....”

**More specific reference but not a direct quote:** “The distribution of Martian volcanism in the highlands (Johnson, 2011) can be used to infer... etc.”

**More general reference to sources:** “Most older textbooks in geology (e.g. Peters et al., 1941; Stamp 1938) either ignored the deep ocean basin deposition or.....”

**Website in text:** “Details about PhD scholarships are available from the Macquarie University web site <<http://www.hdr.mq.edu.au/>>.”

#### *How to create a list of references:*

At the end of your assignment, create a list of the references you have cited in the text. Arrange this in alphabetical order of author's surnames. The author's surname is placed first, followed by initials or first name, then other authors the same way, and then the year of publication is given. Where an item doesn't have an author, arrange it by its title.

Then the reference needs the paper or book title, journal (if it's a journal article), publisher (if it's a book) or url and date accessed (if it's a web page). The format should follow the Harvard style as described in these links: it is a good guide, and your references should contain the same information.

Please be very careful (a) to put in the reference list every citation from the text (including web sites) and any figure/table captions, and (b) to not put in the list references that you have not cited in the text or figure/table captions.

#### **Reference examples: journal**

Cameron, R.L., Goldich, S.S & Hottman, J.H. 1960. Radioactive age of rocks from the Windmill Islands, Budd Coast, Antarctica. *Stockholm Contributions to Geology* **6**, 1-6.

Goodwin, I.D. 1993. Holocene deglaciation, sea level change and the emergence of the Windmill Islands, Budd Coast, Antarctica. *Quaternary Research* **40**, 70-80.

Sandwell, D.T. & Smith, W.H.F. 1997. Marine gravity anomaly from Geosat and ERS 1 satellite altimetry. *Journal of Geophysical Research*, **102**, No B5. 10,039-10,054.

#### **Reference example: book**

Peters, K. E., Walters, C. C. and Moldowan, J. M. (2005) *The Biomarker Guide*, 2nd Edition. Cambridge University Press, Cambridge, 1155 pp.

#### **Reference example: chapters in edited books**

Einstein, A.C., Voldemort, T. M., Vader, D., 2012. How to apply evil. In: Devil, M.A. (Ed.), Handbook of Evil, Wiley, pp. 47-73.

George, S. C., Volk, H., Ahmed, M., Middleton, H., Allan, T. and Holland, D. (2004) Novel petroleum systems in Papua New Guinea indicated by terpane and methylhopane distributions. In: Boulton, P. J., Johns, D. R. and Lang, S. C. (Eds), Eastern Australasian Basins Symposium II, Adelaide, 19–22 September, Petroleum Exploration Society of Australia, Special Publication, pp. 575-588.

**Reference example (web site, author and date known):**

Wright, S. 2004, Open area test site (OATS) development, undergraduate project, University of Southern Queensland, Toowoomba, viewed 27 March 2011, <<http://eprints.usq.edu.au/archive/00000047>>.

**Reference example (web site, author and date not known):**

Macquarie University, NSW, viewed 12 January 2012, <<http://www.hdr.mq.edu.au/>>

## Unit Schedule

DATE	LECTURER	TOPIC	PRACTICAL
Week 1 4 Aug	Mark Lackie	Introduction to the unit Revision of Concepts Dimensional Analysis	Evil (Dim Analysis) (Filtering)
Week 2 11 Aug	Brad Bailey	Oil and Gas Exploration	More Evil (Filtering) (Noddy)
Week 3 18 Aug	Bob Whiteley	Seismic Case Histories	Even more evil (ERM Interpretation)
Week 4 25 Aug	Craig O'Neill	Arduino Introduction	Assignment II



Week 5 1 Sept	Phil McClelland	Case Histories: Magnetics	Assignment II
Week 6 8 Sept			Way past evil (PA Analysis)
Week 7 15 Sept	James Austin	Geophysical Response of Ore bodies	It will hurt
		<b>Mid Semester Recess</b> <b>Field Excursion (24 Sept – 28 Sept)</b>	
Week 8 6 Oct	Simon Williams	Engineering Geophysics	Doomed Doomed (Geosoft)
Week 9 13 Oct	Tim Pippett	Environmental Geophysics	Field data Compilation
Week 10 20 Oct	Dave Pratt	Potential Field Presentation and Interpretation	Field data Compilation
Week 11 27 Oct	Steve Webster	Groundwater Geophysics	Field data Compilation
Week 12 3 Nov	Cameron Fink	Seismic Case Histories	Field data Compilation
Week 13 10 Nov			Field data Compilation

## Learning and Teaching Activities

### Assignments

Interpretation and Practical Assignments

### Oral Presentation

Oral Presentation

### Field Report

Field Report on data acquired on the fieldtrip

### Final Examination

Exam

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

**New Assessment Policy in effect from Session 2 2016** [http://mq.edu.au/policy/docs/assessment/policy\\_2016.html](http://mq.edu.au/policy/docs/assessment/policy_2016.html). For more information visit [http://students.mq.edu.au/events/2016/07/19/new\\_assessment\\_policy\\_in\\_place\\_from\\_session\\_2/](http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/)

Assessment Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Complaint Management Procedure for Students and Members of the Public [http://www.mq.edu.au/policy/docs/complaint\\_management/procedure.html](http://www.mq.edu.au/policy/docs/complaint_management/procedure.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your

student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](#).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Graduate Capabilities

### Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

### Learning outcomes

- understanding of the basic concepts of exploration and environmental geophysics
- understanding scientific methodology
- competence in accessing, using and synthesising appropriate information

- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## **Assessment tasks**

- Assignment II
- Assignment I
- Field Report

## **Capable of Professional and Personal Judgement and Initiative**

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

### **Learning outcomes**

- gaining experience in operating geophysical equipment
- understanding scientific methodology
- application of knowledge to solving problems and evaluating ideas and information

### **Assessment task**

- Field Report

## **Commitment to Continuous Learning**

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

### **Learning outcomes**

- understanding of the basic concepts of exploration and environmental geophysics
- gaining experience in operating geophysical equipment
- understanding scientific methodology
- competence in accessing, using and synthesising appropriate information
- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## Assessment tasks

- Assignment II
- Assignment I
- Field Report

## Discipline Specific Knowledge and Skills

Our 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. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

## Learning outcomes

- understanding of the basic concepts of exploration and environmental geophysics
- gaining experience in operating geophysical equipment
- understanding scientific methodology
- competence in accessing, using and synthesising appropriate information
- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## Assessment tasks

- Assignment II
- Assignment I
- Exam

## Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

## Learning outcomes

- understanding of the basic concepts of exploration and environmental geophysics
- understanding scientific methodology

- competence in accessing, using and synthesising appropriate information
- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## **Assessment tasks**

- Oral Presentation
- Assignment II
- Assignment I
- Field Report

## **Problem Solving and Research Capability**

Our 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; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

## **Learning outcomes**

- understanding of the basic concepts of exploration and environmental geophysics
- understanding scientific methodology
- competence in accessing, using and synthesising appropriate information
- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## **Assessment tasks**

- Assignment II
- Assignment I
- Field Report

## **Effective Communication**

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

## **Learning outcomes**

- understanding of the basic concepts of exploration and environmental geophysics

- understanding scientific methodology
- competence in accessing, using and synthesising appropriate information
- application of knowledge to solving problems and evaluating ideas and information
- capacity to present ideas clearly with supporting evidence

## **Assessment tasks**

- Oral Presentation
- Field Report
- Exam

## **Changes from Previous Offering**

2016. Updated schedule.

## **Changes since First Published**

<b>Date</b>	<b>Description</b>
18/07/2016	Updated Schedule