GEOS385

Global Tectonics

S1 Day 2018

Dept of Earth and Planetary Sciences

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General Information

Unit convenor and teaching staff

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Credit points
3

Prerequisites
6cp in GEOS or MATH or PHYS units at 200 level including GEOS205

Corequisites

Co-badged status

Unit description
This unit integrates recent advances in geodynamics, geophysics, geochemistry, and geology to understand the long-term tectonic evolution of the Earth, and its impact on the surface. Topics covered include structure and dynamics of the Earth, physical processes driving Earth dynamics, fundamentals of modern earthquake seismology, plate motions through time, paleomagnetism, global supercycles, and recent developments in the understanding of mantle/lithosphere dynamics.

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 issues concerning the global tectonics of the earth

Understanding of mantle and lithosphere dynamics

understanding of the basic concepts of tectonic plate motions

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

Name	Weighting	Hurdle	Due
Online Quizzes	7%	No	Various
Assignment I - Geodynamics	6%	No	Week 4
Assignment II- Plate tectonics	6%	No	Week 7
Assignment III - Continents	6%	No	Week 12
Paper presentation	5%	No	Continual
Research Paper & Seminar	20%	No	Week 13
Final Exam	50%	No	July

Online Quizzes

Due: **Various**
Weighting: **7%**

Students will complete 5 online quizzes, on each module of the course.

On successful completion you will be able to:

- Understanding of issues concerning the global tectonics of the earth
- Understanding of mantle and lithosphere dynamics
- understanding of the basic concepts of tectonic plate motions
- Application of knowledge to solving problems and evaluating ideas and information

Assignment I - Geodynamics

Due: **Week 4**
Weighting: **6%**

Assignment on geodynamics module (pracs 1-3)

On successful completion you will be able to:

- 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 II- Plate tectonics

Due: **Week 7**
Weighting: **6%**

Assignment on plate tectonics module

On successful completion you will be able to:

- Understanding of mantle and lithosphere dynamics
- Competence in accessing, using and synthesising appropriate information
- Application of knowledge to solving problems and evaluating ideas and information

Assignment III - Continents

Due: **Week 12**
Weighting: **6%**

Assignment on Continental lithosphere

On successful completion you will be able to:

- Understanding of issues concerning the global tectonics of the earth
- Understanding of mantle and lithosphere dynamics
- understanding of the basic concepts of tectonic plate motions
- Application of knowledge to solving problems and evaluating ideas and information

Paper presentation

Due: **Continual**
Weighting: **5%**

Each student will present the results of one research paper to the class.

On successful completion you will be able to:

- Understanding of mantle and lithosphere dynamics
- Understanding scientific methodology
- Capacity to present ideas clearly with supporting evidence

Research Paper & Seminar

Due: **Week 13**
Weighting: **20%**

Research Paper

On successful completion you will be able to:

- Understanding of issues concerning the global tectonics of the earth
- Understanding of mantle and lithosphere dynamics
- understanding of the basic concepts of tectonic plate motions
- 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

Final Exam

Due: **July**
Weighting: **50%**

Final Exam

On successful completion you will be able to:

- Understanding of issues concerning the global tectonics of the earth
- Understanding of mantle and lithosphere dynamics
- understanding of the basic concepts of tectonic plate motions
- Understanding scientific methodology
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

Delivery and Resources

Lecture Times and Venue:

There will be two lectures (each one hour) and three-hour practicals session on each of week of first semester.

Lectures: 9-11pm Tuesday, 23WW 202.

Practical 1: Wednesday 1-4pm, E5A 270.

TEXTBOOK AND TECHNOLOGY USED

The recommended textbook for the unit is “The Solid Earth (2nd Ed)” by Fowler. The book "Global Tectonics" by Kearey, Klepeis & Vine is a useful text and worth considering.

The unit also has a WEB site which can be found through the Online Learning @ MQ WEBSITE at http://ilearn.mq.edu.au/. This site contains information such as copies of colour images, copies of overheads and PowerPoint’s shown in class and copies of the practicals that we do in class. The WEB site will also allow access to the digital version of the lectures recorded through the iLecture system. As well, this site will access the on-line quizzes that will need to be completed during the semester. At the start of the year you should be issued with a username and password to access all the WEB sites available for the units you have taken. This will get you into the front page of the GEOS385 WEB site.

Below is a list of references that may be helpful in expanding certain aspects of the unit.

REFERENCES

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QE509.B75 Bott M.P., The interior of the Earth (2nd ed.), 1982

*QE501.4.P35.B88 Butler R.F., Paleomagnetism, 1991

*QE527.7 .C66/2001 Condie K.C., Mantle Plumes and their record in Earth History, 2001

QC806.C65 Cook A.H., Physics of the Earth and Planets, 1973

QE511.4.C683/1986 Cox A. & Hart R.B., Plate tectonics: how it works, 1986

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QC806.D39 De Bremaecker J-C, Geophysics: The earth’s Interior, 1985

QB501.N18 Dermott S.F. (Ed), The origin of the Solar System, 1977

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QC827.I7 Irving E., Paleomagnetism, 1964

QE509.E234/1998 Jackson I, The Earth's Mantle, 1998

QE509.J27/1992 Jacobs J.A. Deep Interior of the Earth, 1992

QE509.E232/2000 Karato S. et al, Earth's Deep Interior, 2000

QE511.4.K43/1996 Kearey P. & Vine F.J., Global Tectonics (2 Ed), 1996

*QE511.4.K43/2009 Kearey P., Klepeis K.A. & Vine F.J., Global Tectonics

QE35.E18 McElhinny M.W., The Earth, its Origin, Structure and Evolution, 1979

QE501.4.P35.M35/2000 McElhinny, M.W.& McFadden, P., Paleomagnetism: continents and oceans, 2000

QC816.M4 Merrill R.T. & McElhinny M.W., The Earth's Magnetic Field, 1983

QC816.M47/1996 Merrill R.T., McElhinny M.W. & McFadden P.L. The magnetic field of the Earth: palaeomagnetism, the core, and the deep mantle, 1996

QE511.4.H57/2000 Richards et al, The History and Dynamics of Global Plate Motions, 2000

QE501.S3/1982 Scheidegger A.E., Principles of Geodynamics

QC806.S54/1997 Sleep N.H. & Fujita K., Principles of Geophysics, 1997

QE26.2.C35 Smith D.G. (Ed), The Cambridge Encyclopaedia of Earth Sciences

QC806.S65 Stacey F.D., Physics of the Earth (2nd & 3rd eds.), 1977 & 1992

QE511.44.G46 Summerfield M.A., Geomorphology and Global Tectonics, 2000

QE501.T83 Turcotte D.L. & Schubert G., Geodynamics, 1982

*QE340.B55 Veevers J. J., Billion-year earth history of Australia and neighbours in Gondwanaland, 2000

*QE340.B552 Veevers J.J., Billion-year earth history of Australia

Unit Schedule

Unit schedule subject to revision.

Week	Date	Lecture Number	Lecturer	Lecture Title	Practical
1	27th Feb	1	A/Prof Craig O'Neill	Introduction to Geodynamics	Geodynamic modelling 1
		2	A/Prof Craig O'Neill	The Core	
2	6th March	3	A/Prof Craig O'Neill	The mantle	Geodynamic modelling 2
		4	A/Prof Craig O'Neill	Mantle convection and hotspots	

3	13th March	5 6	A/Prof Craig O'Neill A/Prof Craig O'Neill	The subduction factory The thermal structure of the Earth	Geodynamic modeling 3
4	20th March	7 8	Dr. Mark Lackie Dr. Mark Lackie	Plates and plate margins Plate Motion	Plate reconstructions 1
5	27th March	9 10	Dr. Mark Lackie Dr. Mark Lackie	Marine magnetic anomalies Palaeomagnetism	Plate reconstructions 2
6	3rd April	11 12	A/Prof Craig O'Neill A/Prof Craig O'Neill	The nature of plates Gravity and the Geoid	Ocean Mapping 1
7	10th April	13 14	A/Prof Craig O'Neill A/Prof Craig O'Neill	Thermal evolution of the Earth When did plate tectonics begin?	Geodynamic modeling 4
BREAK					
8	1st May?	15 16	A/Prof. Yingjie Yang A/Prof. Yingjie Yang	Seismology 1 Seismology 2	Seismology 1
9	8th May?	17 18	A/Prof. Yingjie Yang A/Prof. Yingjie Yang	Seismology 3 Seismology 4	Seismology 2
10	15th May	19 20	Prof. Suzanne O'Reilly Prof. Suzanne O'Reilly	The continental lithosphere 4D Lithospheric Mapping	Lithospheric Mapping 1

11	22nd May	21 22	Prof. Suzanne O'Reilly Prof. Suzanne O'Reilly	Plumes and how the Earth Works Archaean Lithospheric Formation	Lithospheric Mapping 2
12	29th May	23 24	A/Prof Craig O'Neill A/Prof Craig O'Neill	Beyond plate tectonics Wrap-Up: The Way the Earth Is	Geodynamic modeling 5: Big data science
13	5th June	25	You	Seminars	Seminars
EXAMS	12th-	29th	June		

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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.

Supplementary exam

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

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) 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

IT Help

For help with University computer systems and technology, visit 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 mantle and lithosphere dynamics
- Understanding scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Capacity to present ideas clearly with supporting evidence

Assessment tasks

- Assignment II- Plate tectonics
- Research Paper & Seminar

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

- Understanding of mantle and lithosphere dynamics
- understanding of the basic concepts of tectonic plate motions
- Understanding scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Application of knowledge to solving problems and evaluating ideas and information

Assessment tasks

- Online Quizzes
- Assignment I - Geodynamics
- Assignment II- Plate tectonics
- Paper presentation
- Research Paper & Seminar

- Final Exam

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 mantle and lithosphere dynamics
- Understanding scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Application of knowledge to solving problems and evaluating ideas and information

Assessment tasks

- Assignment I - Geodynamics
- Assignment II- Plate tectonics
- Assignment III - Continents
- Paper presentation
- Research Paper & Seminar
- Final Exam

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 issues concerning the global tectonics of the earth
- Understanding of mantle and lithosphere dynamics
- understanding of the basic concepts of tectonic plate motions

Assessment tasks

- Online Quizzes
- Assignment I - Geodynamics
- Assignment II- Plate tectonics
- Assignment III - Continents
- Paper presentation
- Research Paper & Seminar
- Final 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 issues concerning the global tectonics of the earth
- Understanding of mantle and lithosphere dynamics
- understanding of the basic concepts of tectonic plate motions
- Understanding scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Application of knowledge to solving problems and evaluating ideas and information

Assessment tasks

- Assignment I - Geodynamics
- Assignment II- Plate tectonics
- Assignment III - Continents
- Paper presentation
- Research Paper & Seminar
- Final Exam

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 mantle and lithosphere dynamics
- Understanding scientific methodology
- Competence in accessing, using and synthesising appropriate information

Assessment tasks

- Assignment I - Geodynamics
- Assignment II- Plate tectonics
- Assignment III - Continents
- Paper presentation
- Research Paper & Seminar

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 scientific methodology
- Capacity to present ideas clearly with supporting evidence

Assessment tasks

- Assignment I - Geodynamics
- Paper presentation
- Research Paper & Seminar
- Final Exam

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to 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. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Understanding scientific methodology
- Competence in accessing, using and synthesising appropriate information

Assessment task

- Research Paper & Seminar

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Understanding scientific methodology
- Competence in accessing, using and synthesising appropriate information

Assessment tasks

- Assignment I - Geodynamics
- Research Paper & Seminar