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# **PALAEOBIOLOGY**

## **ERTH 2002**

### **Participants**

Dr. John M. Pandolfi (course co-ordinator)

Professor Geoff Playford

Dr. Peter Jell

Dr. Alex Cook

Dr. Steve Salisbury

Mr. Daniel Mantle (lab tutor)

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# ERTH 2002 PALAEOBIOLOGY

## Semester 2 - 2004

The course EARTH2002 covers a principal aspect of historical geology: palaeobiology, the nature and development of animal and plant life on Earth as preserved in the rocks of the Earth's crust. Emphasis will be placed on the applications of palaeobiology in the earth sciences, particularly in stratigraphy and palaeoecology, and also in the biological sciences.

The following are among the broad topics to be covered:

- Inception and evolutionary development of animal and plant life through geological time.
- Evolution including major biotic crises and evolutionary bursts.
- Applications of fossils in biostratigraphy, palaeobiogeography, and palaeoecology.

ERTH2002 is a 2 unit course offered during the second semester.

### Staff

#### Lecturers

- DR JOHN PANDOLFI (course co-ordinator), Room 303, Seddon Building; phone 3365 3050; email: [j.pandolfi@uq.edu.au](mailto:j.pandolfi@uq.edu.au) Office Hours: Wed 9:30-11:30 AM
- PROFESSOR GEOFF PLAYFORD, Room 235, Steele Building; phone 3365 2366; email: [g.playford@earth.uq.edu.au](mailto:g.playford@earth.uq.edu.au)
- DR PETER JELL, Queensland Museum; phone 3840 7664; email: [peterj@qm.qld.gov.au](mailto:peterj@qm.qld.gov.au)
- DR ALEX COOK, Queensland Museum; phone 3840 7665; email: [alexc@qm.qld.gov.au](mailto:alexc@qm.qld.gov.au)
- DR STEVE SALISBURY, Zoology; phone 3365 8548; email: [s.salisbury@uq.edu.au](mailto:s.salisbury@uq.edu.au)

#### Tutorial Coordinator

- MR DANIEL MANTLE, Room 209F, Richards Building; phone 3365 8379; email: [d.mantle@uq.edu.au](mailto:d.mantle@uq.edu.au)

#### Laboratory Coordinator

- MR DANIEL MANTLE, Room 209F, Richards Building; phone 3365 8379; email: [d.mantle@uq.edu.au](mailto:d.mantle@uq.edu.au)

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**Web page** The course profile and course material can be found on the web at the following address: <http://www.earth.uq.edu.au/>. This also contains up-to-date news about the course material and announcements for students. Please check this regularly during the semester.

### **Class contact hours:**

**Lectures** will be held as follows:

Monday 10-11 am, in Room 3-222 Steele Building.

Wednesday 12 noon-1 pm, in Room 3-222 Steele Building.

**Practical Classes** will be conducted on Wednesday afternoons, 2–5 pm, in Room 3-228 Steele Building.

### **Assumed background:**

Students should have a basic understanding of invertebrate biology, but skills can be picked up during the class.

### **Course goals/rationale:**

On completing this course students will:

- Gain an understanding of the history of life on Earth
- Be able to apply knowledge of fossils to a wide range of biological and geological problems
- Understand the fundamental role that *Paleobiology* plays in our understanding of the temporal relationships among rock formations
- Understand the relationship between palaeobiology and other biological and geological sciences

### **Graduate Attributes:**

The following graduate attributes will be developed in the course –

### **In-Depth Knowledge of the Field of Study**

- *A comprehensive and well-founded knowledge of Palaeobiology.*
- *An understanding of how Biology, Ecology, Evolution, and Geology relate to Palaeobiology.*
- *An international perspective on the field of Palaeobiology.*

### **Effective Communication**

- *The ability to collect, analyse, and organise information and ideas, and to convey those*

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*ideas clearly and fluently, in both written and spoken forms.* Developed during a term paper and 2 laboratory exercises.

- *The ability to interact effectively with others in order to work towards a common outcome.* Developed during laboratory exercises.

- *The ability to select and use the appropriate level, style and means of communication.* Developed through term paper and exams.

- *The ability to engage effectively and appropriately with information and communication technologies.* Developed through paper, lab exercises, and exams.

## **Independence and Creativity**

- *The ability to work and learn independently.*

- *The ability to generate ideas and adapt innovatively to changing environments.*

Developed through lab exercises.

- *The ability to identify problems, create solutions, innovate and improve current practices.*

## **Critical Judgement**

- *The ability to define and analyse problems.* Developed through paper and lab exercises.

- *The ability to apply critical reasoning to issues through independent thought and informed judgement* Developed through exams.

- *The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.* Developed through paper and lab exercises.

## **Ethical And Social Understanding**

- *An understanding of social and civic responsibility.* Developed through lectures on conservation potential for palaeobiological research.

- *An appreciation of the philosophical and social contexts of a discipline* Developed through course content.

- *A knowledge and respect of ethics and ethical standards in relation to a major area of study*

- *A knowledge of other cultures and times and an appreciation of cultural diversity.*

For more information on the University policy on development of graduate attributes in courses, refer to the web

<http://www.uq.edu.au/hupp/contents/view.asp?s1=3&s2=20&s3=5>.

## **Teaching and Learning Methods**

There will be weekly lab practicals. Knowledge of fossils, their relationships to one another, and their timing of occurrence will be developed. Two practicals will have exercises associated with them, to be evaluated and form part of the grade. All practicals will be the subject of a separate practical exam. Students will maintain a Practical notebook which can later be used during the Practical examination.

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All students are required to submit a term paper. The paper should cover some aspect of Palaeontology in which the student is particularly interested and develop a synthesis of an interesting palaeobiological topic. Writing style will be particularly emphasized, as students will be required to submit a first draft, enabling feedback, and then a final submission.

Students are required to read from a textbook to enhance and supplement the material covered in the lectures. Additionally, students are required to read a popular book that enumerates the fundamental role that palaeontology plays in the geological and biological sciences (*Growth of a Prehistoric Time Scale* by W.B.N. Berry). Copies of the book will be on reserve at the library.

A study guide will be freely distributed for most of the practicals (*Handbook for Palaeobiology Practical Classes*). During the course, separate hand-outs will be provided for practicals involving written exercises. Another guide for the lecture material (*Explanatory notes and diagrams*) is on sale at the Union Bookshop.

## ASSESSMENT

### Required assessment tasks:

Lecture material (50%) – one 2-hour examination held during the second semester examination period. Examination covers both lecture and assigned readings.

Practical work (30%) apportioned thus: two practical exercises (15%); 1-hour practical examination (15%) held during second semester examination period.

Paper (20%). Papers, as per prescribed format (< 1500 words), are to be submitted to the Department of Earth Sciences Office (Steele Building) no later than 12 noon on Friday, 24 September (first draft; returned in class on Monday Oct 4), with final drafts due no later than 12 noon on Friday 22 October 2004.

### Assessment criteria

Answers to written examination questions (both lecture and lab) will be assessed in terms of the extent to which they demonstrate the ability of the student to:

- Define, explain and interrelate the key concepts involved in the course.
- Recognise and enumerate the key events in the history of life.
- Identify characteristic fossils and place them in their proper chronological context.
- Apply palaeontological concepts to biological and geological problems.
- Understand the relationships among key biological entities.
- Gain an appreciation of the contribution of palaeontological data to evolutionary and ecological theory, including systematics, historical biogeography, and community ecology.

Reports from the practical exercises will be assessed in terms of the extent to which they demonstrate the ability of the student to:

- Grasp the significance and application of a palaeontological technique.
- Write a report expressing measurements, analysis and conclusions in a clear and cogent style.

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Term papers will be assessed in terms of the extent to which they demonstrate the ability of the student to:

- Synthesize a scientifically interesting and relevant topic, providing insight over and above a summary of facts, in a clear and cogent style.
- Correctly cite the primary scientific literature.
- Show improvement in revision of document between first and final submissions.

### **Criteria for the award of grades**

Your grade for this course will be determined by which of the following levels of achievement that you consistently display in the items of summative assessment.

Grade of 7: the student demonstrates an excellent understanding of the theory of the topics listed in the course outline and is highly proficient in applying the techniques to solve both theoretical and practical problems.

Grade of 6: the student demonstrates a comprehensive understanding of the theory of the topics listed in the course outline and is proficient in applying the techniques to solve both theoretical and practical problems.

Grade of 5: the student demonstrates a good understanding of the theory of the topics listed in the course outline and can apply the techniques to solve problems.

Grade of 4: the student demonstrates an understanding of the theory of the topics listed in the course outline and demonstrates a knowledge of the techniques used to solve problems.

Grade of 3: the student demonstrates some understanding of the theory of the topics listed in the course outline and demonstrates a knowledge of the techniques used to solve problems.

Grade of 2: the student demonstrates limited understanding of the theory of the topics listed in the course outline and demonstrates limited knowledge of the techniques used to solve problems. This includes attempts at expressing their deductions and explanations and attempts to answer a few questions accurately.

Grade of 1: the student demonstrates very limited understanding of the theory of the topics listed in the course outline and of the basic concepts in the course material. This includes attempts at answering some questions but demonstrating very limited understanding of the key concepts.

### **Assessment policy**

Lecture/readings and Practical examinations to be held during the University's exam week cannot be re-scheduled. Lab exercises must be turned in no later than 1 week after they are assigned. Late lab exercises will not be accepted, unless accompanied by a doctor's certificate. Similarly, submission of the first draft of the term paper will not be accepted after the submission date of 12 noon on Friday, 24 September. Students who fail to meet this deadline will forego their opportunity to obtain guidance for their papers, and final papers will be graded with 85% maximum grade.

Students should be familiar with the rules that relate to assessment in their degrees as well as general university policy such as found in the General Award Rules. These are all set out on the myAdvisor page on the UQ website

<http://www.uq.edu.au/student/GeneralRules2003/2003GARs.htm>.

### **Plagiarism:**

Plagiarism is the action or practice of taking and using as one's own the thoughts or writings of another (without acknowledgement). The following practices constitute acts of plagiarism and are a major infringement of the University's academic values:

- (a) **where paragraphs, sentences, a single sentence or significant part of a sentence which are copied directly, are not enclosed in quotation marks and appropriately footnoted;**
- (b) **where direct quotations are not used, but are paraphrased or summarised, and the source of the material is not acknowledged either by footnoting or other simple reference within the text of the paper;**
- (c) **where an idea which appears elsewhere in print, film or electronic medium is used or developed without reference being made to the author or the source of that idea.**

When a student knowingly plagiarises someone's work, there is intent to gain an advantage and this may constitute misconduct.

Students are encouraged to study together and to discuss ideas, but this should not result in students handing in the same or similar assessment work. Do not allow another student to copy your work. While students may discuss approaches to tackling a tutorial problem, care must be taken to submit individual and different answers to the problem. Submitting the same or largely similar answers to an assignment or tutorial problem may constitute misconduct.

If a deliberate act of plagiarism is proven, the results of the assessment will be annulled and other action may be taken as is considered appropriate in the circumstances of the case.

For more information on the University policy on plagiarism, please refer to <http://www.uq.edu.au/hupp/contents/view.asp?s1=3&s2=40&s3=12>

### **Supplementary examinations**

A supplementary examination may be awarded in one course to students who obtain a grade of 2 or 3 in the final semester of their program and require this course to finish their degree. You should check the rules for your degree program for information on the possible award of supplementary examinations. Applications for supplementary examinations must be made to the Director of Studies in the Faculty.

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EPSA Faculty policy on the award of supplementary exams may be found via the Faculty Guidelines from the EPSA student page  
<http://www.epsa.uq.edu.au/index.html?id=9329&pid=7564>

### **Special examinations**

If a student is unable to sit a scheduled examination for medical or other adverse reasons, she/he can and should apply for a special examination. Applications made on medical grounds should be accompanied by a medical certificate; those on other grounds must be supported by a personal declaration stating the facts on which the application relies.

Applications for special examinations for central and end-of-semester exams must be made through the Student Centre. Applications for special examinations in school exams are made to the course coordinator.

More information on the University's assessment policy may be found  
<http://www.uq.edu.au/hupp/contents/view.asp?s1=3&s2=30&s3=5>

EPSA Faculty policy on the award of special exams may be found via the Faculty Guidelines from the EPSA student page  
<http://www.epsa.uq.edu.au/index.html?id=9329&pid=7564>

### **Feedback on assessment:**

You may request feedback on assessment in this course progressively throughout the semester from the course coordinator. Feedback on assessment may include discussion, written comments on work, model answers, lists of common mistakes and the like.

Students may peruse examinations scripts and obtain feedback on performance in a final examination provided that the request is made within six months of the release of final course results. After a period of six months following the release of results, examination scripts may be destroyed.

Information on the University's policy on access to feedback on assessment may be found at  
<http://www.uq.edu.au/hupp/contents/view.asp?s1=3&s2=30&s3=5>

EPSA Faculty policy on assessment feedback and re-marking may be found at  
<http://www.epsa.uq.edu.au/index.html?id=7674&pid=7564>

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## Textbook and references

### Textbook:

STEARNS, C.W. & CARROLL, R.L. *Paleontology: The record of life*. Wiley. 1989.

### On reserve at the Dorothy Hill Physical Sciences and Engineering Library:

BERRY, W.B.N. *Growth of a Prehistoric time scale*. W.H. Freeman and Co., 1968.

### Reference Books

BLACK, R.M. *The elements of palaeontology*, 2<sup>nd</sup> ed. Cambridge Univ. Press. 1988.

BOARDMAN, R.S., CHEETHAM, A.H. & ROWELL, A.J., eds. *Fossil invertebrates*. Blackwell. 1987.

CARROLL, ROBERT L. 1987. *Vertebrate Paleontology and Evolution*, W.H. Freeman & Company.

CLARKSON, E.N.K. *Invertebrate palaeontology and evolution*, 3<sup>rd</sup> ed. Allen & Unwin. 1993.

DOYLE, P. *Understanding fossils: an introduction to invertebrate palaeontology*. Wiley. 1996.

LANE, N.G. *Life of the past*, 3<sup>rd</sup> ed. Merrill. 1992.

RAUP, D. M. AND STANLEY, S. M., *Principles of Paleontology*, San Francisco, 1971, cl, 388 pages,

STEWART, W.N. & ROTHWELL, G.W. *Paleobotany and the evolution of plants*, 2<sup>nd</sup> ed. Cambridge Univ. Press. 1993.

TAYLOR, T.N. & TAYLOR, E.L. *The biology and evolution of fossil plants*. Prentice-Hall. 1992.

WILLIS, K.J. & McELWAIN, J.C. *The evolution of plants*. Oxford University Press. 2002.

### Programs

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PRIMER

### Library contact:

The liaison librarian for the physical sciences disciplines is located in the Physical Sciences and Engineering Library in the Hawken Building and may be consulted for assistance in the course:

Leith Woodall

Email: [l.woodall@library.uq.edu.au](mailto:l.woodall@library.uq.edu.au)

Extension: 52367

### Students with disabilities:

Any student with a disability who may require alternative academic arrangements in the course is encouraged to seek advice at the commencement of the semester from a Disability Adviser at Student Support Services.

### Assistance for Students:

Students with English language difficulties should contact the course coordinator or tutors for the course.

Students with English language difficulties who require development of their English skills should contact the Institute for Continuing and TESOL Education on extension 56565.

The Learning Assistance Unit located in the Relaxation Block in Student Support Services. You may consult learning advisers in the unit to provide assistance with study skills, writing assignments and the like. Individual sessions are available. Student Support Services also offers workshops to assist students. For more information, phone 51704 or on the web <http://www.sss.uq.edu.au/index.html>.

### Student Liaison Officer:

The School of Physical Sciences has a Student Liaison Officer as an independent source of advice to assist students with resolving academic difficulties.

The Student Liaison officer during 2004 will be Dr Peter Adams, Room 547 Priestley building, (email [pa@maths.uq.edu.au](mailto:pa@maths.uq.edu.au))

### Program of work for the semester:

#### LECTURE SCHEDULE (Readings in parentheses)

##### WEEK 1

**Jul 26** Introduction to EARTH 2002 and the fossil record  
(Ch. 1, 2 and 3) John Pandolfi

**Jul 28** Precambrian life  
(Ch. 4) John Pandolfi

##### WEEK 2

**Aug 2** Origin & diversification of Metazoa  
(Cambrian explosion and Sepkoski curve)  
(Ch. 5; Ch.7: 143-144, 165-168) John Pandolfi

**Aug 4** Mollusca 1: bivalves and gastropods  
(Ch. 7:116-130; Ch 10: 221-229) Alex Cook

##### WEEK 3

**Aug 9** Mollusca 2: cephalopods  
(Ch. 7:116-130; Ch 10: 229-235) Alex Cook

**Aug 11** Exhibition Holiday

##### WEEK 4

**Aug 16** Palaeozoic marine arthropods: trilobites  
(Ch. 7:133-140) Peter Jell

**Aug 18** Other arthropods  
(Ch. 7:130-133, 140-143) Peter Jell

**WEEK 5**

**Aug 23** Echinodermata 1 Peter Jell  
(Ch. 7:145-157)

**Aug 25** Echinodermata 2 Peter Jell  
(Ch. 10:235-240)

**WEEK 6**

**Aug 30** Reefal invertebrates: archaeocyathids & stromatoporoids John Pandolfi  
(Ch. 6:83-89)

**Sept 1** Reefal invertebrates: corals John Pandolfi  
(Ch. 6:90-101; Ch. 10:220-221)

**WEEK 7**

**Sept 6** Benthic/lophophorate invertebrates: brachiopods, bryozoans John Pandolfi  
(Ch. 6:101-115; Ch 10:240)

**Sept 8** Biostratigraphy, taphonomy and temporal resolution John Pandolfi  
(Ch. 13; Ch 17:376-381)

**WEEK 8**

**Sept 13** Origin and diversification of the land plants (1) Geoff Playford  
(Ch. 8)

**Sept 15** Land plants (2) Geoff Playford  
(Ch. 8)

**WEEK 9**

**Sept 20** Land plants (3) Geoff Playford  
(Ch. 8)

**Sept 22** Plant microfossils Geoff Playford  
(Ch. 8)

**Mid Semester Break****WEEK 10**

**Oct 4** Palaeoecology & palaeobiogeography John Pandolfi  
(Ch. 17 and 18)

**Oct 6** Phylogenetic reconstruction and the species concept John Pandolfi  
(Ch. 3)

**WEEK 11**

**Oct 11** Adaptation and functional morphology Peter Jell  
(Ch. 14)

**Oct 13** Evolutionary mechanisms Peter Jell  
(Ch. 15 and 16)

**WEEK 12**

**Oct 18** Origin and diversification of the vertebrates Steve Salisbury

**Oct 20** Palaeozoic vertebrates Steve Salisbury  
(Ch. 9)

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**WEEK 13**

**Oct 25** Mesozoic vertebrates  
(Ch. 11)

Steve Salisbury

**Oct 27** Cenozoic vertebrates  
(Ch. 12)

Steve Salisbury

**\*\*N.B.** Papers, as per prescribed format (6-10 double spaced pages, 12 pt font), are to be submitted to the Department of Earth Sciences Office (Steele Building) no later than 12 noon on Friday, 24 September (first draft; returned in class on Monday Oct 6), with final drafts due no later than 12 noon on Friday 22 October 2004.

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**PRACTICAL SCHEDULE**

**Practicals will be taught as if this were a separate course in the History of Life (30-min lecture) along with Stratigraphical Paleontology (specimens).**

**WEEK 1**

**July 28** Cambrian – Silurian fossils Geoff Playford

**WEEK 2**

**Aug 4** Cambrian – Silurian fossils Geoff Playford

**WEEK 3**

**Aug 11** Exhibition Day Public Holiday

**WEEK 4**

**Aug 18** Devonian – Carboniferous fossils Alex Cook

**WEEK 5**

**Aug 25** Permian fossils John Pandolfi

**WEEK 6**

**Sept 1** Triassic - Jurassic fossil Alex Cook

**WEEK 7**

**Sept 8** Biostratigraphy and paleoecology I  
(Exercise 1 explained) Alex Cook

**WEEK 8**

**Sept 15** Biostratigraphy and paleoecology II  
(Exercise 1 assigned) Alex Cook

**WEEK 9**

**Sept 22** Cretaceous faunas and floras  
(Exercise 1 due) John Pandolfi

**Mid Semester Break****WEEK 10**

**Oct 6** Paleocommunity and diversity analysis I  
(Exercise 2 explained) John Pandolfi

**WEEK 11**

**Oct 13** Paleocommunity and diversity analysis II  
(Exercise 2 assigned) John Pandolfi

**WEEK 12**

**Oct 20** Cenozoic faunas and floras  
(Exercise 2 due) John Pandolfi