

WELCOME

Welcome to Oxford, or welcome back to Oxford!

Whether you are arriving for the first time, or returning for another year, you should find that this handbook contains the key information that you need to navigate your way around the Earth Sciences degree course.

In the following sections, our aim is to provide you with the information that you need to know about the means by which teaching is carried out; the structure of the course, the details of options, the logistics of practical work and fieldwork, and modes of examination and assessment. It also contains all of the important dates (of teaching terms, course-work submission deadlines, field trips and so on), that will need to be aware of through the year.

This handbook is available in both hard copy and on the web, and links to this and other web based resources can be found through the 'undergraduate course' links on the departmental website and through WebLearn (http://www.earth.ox.ac.uk/undergraduate_course). Do check for updates during the year.

If you have any questions regarding the course or the department, make sure to consult this handbook first - it should be a mine of information.

If you can't find the answer to any particular questions you have relating to the course, you should contact your college tutor or the Undergraduate Course Advisor.

It is important to note that this handbook only pertains to this current academic year and new handbooks will be produced for each year of the course: the Earth Sciences course is constantly evolving as staff change and knowledge develops.

Don Porcelli (Chair of Faculty)

Heather Bouman (Undergraduate Course Advisor)

How to use this handbook

At the beginning of this handbook, you can find general information, organised alphabetically, relating to all undergraduate students in 2011-12. You will then find separate sections for 1st, 2nd, 3rd and 4th years, including course details and other important information. **At the beginning of each of these sections is a table of important dates - please put these dates in your diary now.** At the end of the handbook are the appendices, relevant to all students.

Other sources of information

1. **Grey Book:** This contains the full examination regulations. You can access it online at: <http://www.admin.ox.ac.uk/examregs/>

2. **Online Handbook:** This can be accessed on the Departmental website here: http://www.earth.ox.ac.uk/undergraduate_course, and on WebLearn here: https://weblearn.ox.ac.uk/portal/hierarchy/mpls/earth/ugrad/page/course_handbook

3. **Lecture List:** This is circulated via email at the start of each term. Students are also notified of any major updates via email. It can also be found on **WebLearn** here:

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<https://weblearn.ox.ac.uk/portal/hierarchy/mps/earth/ugrad>

In 2010-11 we introduced new timetabling software - please look out for email updates on developments.

4. Proctors' and Assessors' Memo: This contains essential information for students, and can be found here:

<http://www.admin.ox.ac.uk/proctors/info/pam/index.shtml>

5. Health and Welfare: The University website has a general guide to student health and welfare issues (<http://www.ox.ac.uk/students/shw/>).

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GENERAL INFORMATION A-Z

Here is the essential information about the Earth Sciences degree courses.

You can also find this document on the department website.

This is information for 2011-12 only.

Accreditation

The undergraduate courses are accredited by the **Geological Society of London**.

Aims and Objectives of the Department

1. To provide students with a course of the highest academic quality in a challenging but supportive learning environment.
1. To provide students with a broad, balanced knowledge of Earth Sciences.
2. To develop transferable skills related to problem solving, communication, practical techniques and computing.

Assessment

PLEASE ALSO REFER TO THE EXAMINATION REGULATIONS IN THE "GREY BOOK" FOR 2011-12.

You can find this online at:

<http://www.admin.ox.ac.uk/examregs/>

Ongoing Feedback

Work completed for practicals or fieldwork exercises may be assigned a mark. These marks do not aggregate to your degree result, but you should treat them as important indicators of the quality of your work. In addition, tutorial work will also commonly be assessed and your college will take a keen interest in the standards you achieve. Again, these marks do not contribute to your degree classification, but they do provide valuable feedback to you on your understanding of the material of the course.

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Note that, although they will not make use of the **marks for** field and practical courses, Finals examiners may take into account **completion** and standards achieved when they set the borderlines between classes of degree.

Students are also provided a wide range of informal feedback in tutorials and in discussions with instructors in classes, practicals, and on fieldtrips.

Examinations

The degree course at Oxford is divided officially into two sections with a hurdle at the end of the first year. This test, the Preliminary Examination in Earth Sciences (otherwise known as the First Public Examination - or Prelims) must be passed in order to proceed to the Final Honour School (usually shortened to 'Finals') that is examined in years 2, 3 and 4.

If candidates are sick, or have any other extenuating circumstances that might affect their examination or coursework, they should contact their college office, **NOT** the Examiners or the Academic Administrator.

Examining Conventions for Prelims

Each year the Faculty of Earth Sciences elects four Prelims Examiners from among the academic staff of the Department.

The Preliminary Examination consists of five papers covering the four subjects taken in the first year. Students take Planet Earth, Fundamentals of Geology I and II, Physics, Chemistry and Biology, and Mathematics for Materials and Earth Sciences. There is also a compulsory practical examination. The results of the Preliminary Examination are not classified (into 1st, 2nd class etc.), but candidates are required to pass every paper. Candidates who do not pass Prelims at the first attempt will have to pass the re-sit examinations in September. The top candidates may be awarded a Distinction, and outstanding performance may also lead to an award from the student's college.

Examining Conventions for Finals

The conventions and procedures used in marking written examinations and other assessed work, and in aggregating marks to derive a degree result are described in Appendix 1. It is based on the Final Examiners' current practice, following also the University's internal guidelines as issued by the Examination Schools and the Educational Policy and Standards Committee.

Examiners

Each year, the Faculty of Earth Sciences elects three Finals Examiners from among the academic staff of the Department. In addition, the sub-faculty nominates two External Examiners - one for Part A and one for Part B. Usually, the Part A External Examiner for one year becomes the Part B External Examiner for the same cohort of students in the following year. The External Examiners have two principal roles. The first is, under guidelines imposed nationally and by the University, to report on the standards of the examinations and the procedures under which they are carried out. The second role is to act as moderators and arbitrators within the examination procedures. These roles are laid out more fully in Section 2.5. It should be noted that candidates may not directly communicate with the Examining Committee regarding any examining issue; advice regarding how to address any issue should be obtained from the dept Academic administrator or the candidate's college tutor.

Assessors

All eligible senior members of the staff of the Department of Earth Sciences who have taught courses to the candidates are invited to become Assessors for Parts A and B of the Final examination. Assessors may set and mark questions and papers, but they play no part in the final aggregation of marks and classification of degree results.

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■ Descriptors for Marking

Each answer to a question in written and practical papers is allocated a mark in the range 0-100, according to the Marking Descriptors given in Appendix 1.. The marks for each answer are added to give a total for each paper, except that if more than the specified number of questions is answered, answers with the lowest marks will be excluded, until the requisite number of answers is reached.

Mapping Reports, 3rd-Year Essays and 4th-Year dissertations are allocated marks in the range 0-100, according to relevant marking descriptors, given in Section 2.6.

■ Marking Procedure

All scripts are double-marked “blind”. Each assessor has the model answer, but neither assessor has knowledge of the mark assigned by the other. Assessors do not write on scripts during the marking process, except to indicate objective errors, e.g. in a calculation. Where a significant discrepancy occurs between the two marks, either the script is returned to the assessors to agree a mark jointly, or the script is moderated by the examiners. The same procedure is applied to essay assignments and projects. The fourth-year project is double marked by two internal assessors and moderated by the External Examiner. The mapping project is double marked internally and is moderated by the External Examiner.

■ Interviews with External Examiners

The External Examiners will be present at, and contribute to, the Final Examiners’ meetings at which marks and classifications are confirmed and finalised, for the Part (A or B) to which they are appointed.

In pursuance of their two principal roles, as outlined in Section 2.4.1 above, the External Examiners will carry out **two different types of meeting with candidates.**

(i) Following Part A, the External Examiner for Part A will have the opportunity to speak to students in small groups to obtain course feedback. These conversations will play no part whatsoever in the assignment of marks or degree classification.

(ii) Following Part B, the External Examiner for Part B will interview students for the purposes of supplementary assessment.

Note that 2nd-Year (Part A1) candidates will not be involved in either type of interview.

■ Degree classification

The marks for each unit of assessment (Exam Paper, Mapping Report, Essay, and Dissertation) will be given the relative weights shown in the Table in Appendix 1. The aggregate mark will be expressed as a percentage to be used in assigning the degree classification.

Because of the small class size, no re-normalization of the marks will be carried out to account for unexpectedly low or high average marks in individual papers. However, the Examiners monitor the distribution of marks assigned for each paper to ensure, among other considerations, that there is a fair balance between the optional sections of Part A, and between the different papers in Part B, and to ensure that no candidate is disadvantaged purely as a result of their choice of topic.

The boundaries between degree classes will follow closely the University conventions shown in the table below, but will not lie exactly on the class divisions shown in the table. In defining class boundaries, the Examiners will take into account the distribution of candidates’ marks over the papers, together with submitted practical materials and assessments by the External Examiner which will, in Part B, be informed by interviews with the candidates.

First Class	70 and above
Upper Second	60 to 69
Lower Second	50 to 59
Third	40 to 49
Pass Degree	30 to 39

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Fail	Less than 30
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Degree Classification for the BA in Geology and the MEarthSci

Students graduating at the end of their third year will be awarded a classified degree based on their Part A marks, as described above. (Note that that these candidates will not be interviewed by the External Examiner for the purpose of assessing their performance.) Students who intend to proceed to the MEarthSci will not be awarded a degree classification; their marks will be carried over for use in the classification procedure in combination with their Part B marks, and the end of their fourth year. In the case of a student who leaves after taking Part A exams, but before completing Part B, the Examiners will revisit the student's Part A marks, and will assign a degree classification following the procedure in Section 2.4.

Role of External Examiners

External examiners will be used primarily for the purposes of moderation and arbitration.

National guidance requires external examiners to report on three major areas:

- (i) whether the standards set are appropriate for the award;
- (ii) the standards and comparability of student performance in the programme;
- (iii) the extent to which procedures for assessment, examination and the determination of awards are sound and have been fairly conducted.

The Department will allow external examiners to:

- (a) have opportunity to comment on all examination papers in draft form;
- (b) have access to all scripts and other material submitted by candidates;
- (c) see a sample of scripts including scripts at the borderlines of classes;
- (d) see a sufficient sample of dissertations, extended essays and course work to be able to comment on the marks awarded;
- (e) be in a position to comment on the fairness of any procedures for the reconciliation of marks, moderation, scaling and adjustments arising out of medical or other evidence.

In relation to (e), the University does not regard this as requiring the external examiner to give a definitive final mark where there is initial disagreement between first markers (although examining boards may choose to ask the external examiner(s) to act in this way) but to be in a position to report on the soundness of the procedures used to reach a final agreed mark.

The Honours School of Earth Sciences appoints a Part A External Examiner each year, and this examiner's duties continue the following year when they become Part B External Examiner for the same cohort of students. In addition to previewing papers, the Department will also send the mapping projects to the Part A external examiner following internal marking, for the purposes of independently considering the projects before seeing internal marks. The Department will also send the 4th year projects to the Part B external examiner, for the purposes of providing a suggested nominal mark to compare to the two internal marks.

The external examiners will have the opportunity to speak to students in small groups to obtain course feedback (following Part A), and to interview students for the purposes of supplementary assessment (following Part B). They will be present at, and contribute to, the final examiners meetings where marks and classifications are confirmed and finalised.

Communication

Please ensure you regularly check your departmental email address, as this is the primary form of communication used to send students important information

Staff have pigeonholes in the corridor by the admin offices on the ground floor of the new building.

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Email addresses, telephone numbers and college affiliations are given in Appendix 4 at the back of this booklet. Notices concerning examinations, field courses etc. are posted on the notice boards outside reception.

Feedback and Consultation

In Weeks 4 and 8 each term, feedback questionnaires are distributed via WebLearn. You can help us improve the course by commenting (anonymously if you wish) on those aspects of the teaching you found particularly helpful or areas in which you see scope for change. These comments and questionnaires are read by teaching staff and discussed by the Joint Consultative Committee (Undergraduate) [JCC(U)] and the Academic Committee. Students are encouraged to pass comments and suggestions for improvements to the JCC(U) at any time.

Fieldwork Contributions

All students contribute annually towards the cost of fieldwork expenses. The current cost is £250 per annum for student who began their course prior to 2011-12, and £350 per annum for students who began in 2011-12 onwards (to rise annually with inflation). A cheque payable the Department of Earth Sciences should be handed in to the Finance Office in Michaelmas Term.

Geolsoc

The University Geological Society organizes lectures, field excursions and social events throughout the year. Through attending these activities you will not only get to know your fellow students much better, but will also benefit academically.

Joint Consultative Committee (Undergraduate) - JCC(U)

Concern about any aspects of the course can be discussed by the Joint Consultative Committee (Undergraduate) of the Earth Sciences Faculty (JCC(U) for short). This committee consists of two student representatives from each year, the Undergraduate Course Advisor and administrative staff. It meets once a term. Students are encouraged to contact a student representative before the meeting if they have issues they would like to be discussed. The issues raised by the students are also brought to the Earth Sciences Faculty and its Academic Committee for further discussion. A student representative is invited to attend the Faculty meeting each term.

Volunteers are requested at the Induction meeting and informally. Please contact Elaine Sherrott if you want to become involved.

The Labs

The Mineralogical Laboratory

The mineralogy laboratory is the teaching laboratory equipped for mineralogical and petrological study.

One of the principal activities in the laboratory is the study of **thin sections** of geological materials with the polarising **microscope**. Each student is allocated their own microscope, and is encouraged to develop and practise good technique in optical mineralogy and skill in mineral identification.

The laboratory contains extensive collections of teaching materials, including mineral specimens, hand specimens of rocks, thin sections of rocks and minerals, and crystal models (to illustrate both morphology and internal structure). There is a small reference library of relevant handbooks to aid study and

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identification. Students are encouraged to use all of the reference materials which are available, but are also asked to take care with delicate samples, and to replace everything after use.

There are facilities for a whole class to view microscope images via a digital camera attached to a polarising microscope, and thin sections can also be viewed at low magnification (valuable for examining microstructures) on the Petroscope, an adapted microfiche reader fitted with polarisers.

Through much of the academic year a demonstrator is on duty one afternoon per week (usually Wednesday) out of class hours to help undergraduates with their practical mineralogy and petrology.

Elementary Laboratory

Contains collections of fossils (invertebrate fossils and microfossils) and sedimentary rocks used in practicals and maps.

a. Invertebrate palaeontology:

There are separate stacks of drawers of material for practicals in the First Year and Second Year. During the Second Year, students are especially recommended to examine the taxonomic drawers relating to bivalves, echinoderms, cephalopods, brachiopods, corals, trilobites and graptolites, in conjunction with provided notes. These fossils are used to illustrate the morphology and diversity of each group covered in the lecture course.

b. Micropalaeontology:

Two slide cabinets contain examples of all the major microfossil groups. In the First Year, some use is made of the introductory slides showing radiolaria, diatoms, coccoliths and foraminifera. Special problem assemblages of foraminifera are utilised during practicals in Micropalaeontology in the Third Year. Those taking that course should also examine the teaching set of 20 foraminiferid genera, along with the accompanying notes. There are also extensive collections of Precambrian microfossils.

Computing Laboratory

PC workstations are linked to a Windows server.

Every student is given their own account, email facility and personal file space. Printing and scanning facilities are available. Students have access to a standard set of Windows office applications. Other more specialized software is used for teaching, notably mathematical packages (such as Matlab) and software for 3D visualization of geological structures.

Libraries

Students can use at least three libraries to access Earth Sciences resources: the Departmental Library and the Radcliffe Science Library (RSL), and their own College Library. Books can be borrowed from the Departmental and College Libraries; the Radcliffe Science Library is mainly for reference only but some undergraduate text books can be borrowed. The Departmental Library takes numerous journals and more extensive collections are available in the RSL.

The Departmental Library, as well as housing books and journals, contains maps, memoirs of geological surveys from around the world, and a large collection of reprints that are available for borrowing. Computer terminals give access to on-line bibliographic services and the internet and are available for student use. (see Appendix 5 for more information).

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New Building

In September 2010, the Department moved to a new building, which combines world-class teaching and research facilities, and is the flagship for Oxford University's redevelopment of its Science Area.

The formal teaching facilities (labs, lecture rooms and library) in the building are all concentrated on the ground floor, connected by the atrium and the new undergraduate common area.

Access to the building out of hours will be controlled by your university swipe cards, with entry through the door next to the rotating door at the front of the building, or through the bike shed at the back of the building.

Pandemics

The Department (and the wider University) are used to responding quickly to events which might have a significant impact on the provision of teaching, or the smooth running of the examinations. In previous years, for example, we had to respond to the flu pandemic, and the disruption which followed the Icelandic eruption.

University advice on Flu Pandemics can be found here:

<http://www.ox.ac.uk/flu/>

The Department will notify you via email of any Department-specific information or developments.

Printing Costs

Undergraduates are charged for black and white printing at the cost of 5p per sheet of paper, and colour printing at 10p per sheet of paper. Printing by each student is logged by the printer on the teaching network. At the beginning of each year students who wish to print in the department pay £10 in advance. Once this has been used you can pay a "top up". You can find out how much you've got left you can access current printing costs at any time on PCs in the Undergraduate Computing Laboratory (once you have logged in if you hover over the £-sign on the task bar current printing charges will be shown).

On leaving the Department, students should go to the Finance Office on the ground floor to receive a refund if they have printed less than their £10

In Trinity Term, 4th year students will be allocated £12 printing credit to allow them to print out their 4th year projects - this will, of course, not be refunded on leaving.

In the interests of economy and the environment please print double-sided or, better, use a USB Flash Pen Drive instead of printing at all.

Prizes for Outstanding Academic Work

In recognition of outstanding academic achievement the following prizes are awarded at the Finals Party on the Friday of 9th Week:

Name of prize	Awarded For	Amount
ISC Prize	Best performance in 1 st year Mathematics & Geophysics	£200
BP 2 nd Year Prize	Best performance in 2 nd year	£250
Palaeontological	Best 3 rd year performance in Palaeontology	2 years free membership

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Association Prize		
Mineralogical Association Prize	Best 3 rd year performance in Mineralogy	2 years free membership and free journal subscription
Keith Cox Prize	Best 2 nd year mapping exercise in Assynt	£100
Gibbs Prize	Best FHS mapping report	£180
Shell Prize	Best 3 rd year performance in geochemistry	£700
AWE Prize in Geophysics	Best 3 rd year performance in geophysics	£300
Schlumberger Prize for Best Performance in Geophysics	Best 4 th year performance in Geophysics	£750
BP Prize	Best 4 th year project	£750
Shell Prize	Best overall performance in 4 th year FHS	£700

Safety

For reference, our detailed Statement of Safety is distributed separately, and is also available at (www.earth.ox.ac.uk/internal/Safety/Policy.html) **Note that all planned field and laboratory activities should be discussed in detail with the appropriate academic and technical staff in order to define specific safety procedures.** This should include proper handling of all equipment, instrumentation and chemicals.

■ Safety in the Field

Fieldwork as part of the Earth Sciences degree involves a degree of risk. Training in identifying these risks and the safety procedures required to minimise them form an integral part of the course. The department takes the safety aspects of fieldwork very seriously and all students are given training in field safety. This training begins in the 1st year with compulsory pre-trip safety briefings for all field trips, and this procedure continues in all subsequent years. A safety course and a first aid course is provided to 2nd years to prepare them for their summer mapping projects.. Any student found breaching the safety guidelines will be removed from a field course. In the second year, prior to undertaking the independent mapping project, all students must attend a course on outdoor skills and safety in the field. In addition, complete risk assessments must be carried out for all projects prior to the commencement of any fieldwork (see <http://weblearn.ox.ac.uk/site/mathsphys/earth/dept/riskassessnt/>).

■ Safety in the Laboratory

Mr Steve Wyatt (Departmental Safety Officer, Tel: 72005; e-mail: stevew@earth.ox.ac.uk)
Principal safety issues arise for undergraduate laboratory work in the fourth year of study. Laboratory Managers with responsibility for safety within specific laboratories are listed in the Statement of Safety. All students will receive rigorous safety instruction before they are allowed to carry out laboratory work in connection with their fourth year projects. It is the student's responsibility to obtain explicit approval before entering any laboratories or beginning any new activities. Statement of Safety (www.earth.ox.ac.uk/internal/Safety/Policy.html)

Student Support and Guidance

Student health and welfare are primarily College responsibilities: tutors, and other confidential advisers make up a sympathetic and effective network of support for students. However, you should always feel free to approach any member of the staff that you feel comfortable talking to with any issues or concerns you may have.

The University has a Counselling Service available to help students, and the Student Union has officers working actively to promote student health and welfare. The *Proctors' and Assessor's Memorandum*, which

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is available from Colleges, provides general information on welfare, finance, health and recreation, as well as on student conduct and on the running of University examinations.

The Department currently has two trained harassment advisers - Dr Conall Mac Niocaill and Dr Helen Johnson. Any information is treated in strict confidence.

Study Skills

Essay Writing and Numerical Skills

The complex nature of geological information means that essay writing is still a necessary skill for tutorials and examinations. The essay style to be aimed for here should generally be that of a short scientific review article. Non-numerical answers should be provided with a logical structure, introduction, clear headings, labelled figures, a conclusion. Parts of the course (notably the geophysical options) draw more greatly upon numerical skills. These can be improved through a range of tutorial classes which are available.

Laboratory Work

Skills in handling geological materials are introduced during scheduled practical classes in the Department of Earth Sciences, and during tutorial classes. These materials will include sedimentary, igneous and metamorphic rocks, fossils, structures, geological maps, geophysical and geochemical data. The interpretation of geological maps is considered a core skill, which requires three dimensional thinking. It is expected that students will have basic computer and word-processing skills. Practicals will include work in the Computing Laboratory, while preparation for essays and reports is likely to involve extensive use of library facilities and internet searches.

Field Work

There are up to ninety days of field work, including field training and a four to six week Independent (usually Mapping) Project, in the BA and MESC degrees. Careful observations on outcrops in the field note book should be accompanied by careful and reasonably accurate field sketches which should follow the OASIS rule (orientation, annotation, sketch what you see, interpretation, scale), together with quantitative measurements such as strike and dip. Careful organization, neat writing, and scientific drawing skills should be developed. Remember that the independent mapping project comprises over 20% of the Part A examination.

Please note that all field trips are provisional, and may have to be re-arranged, altered or cancelled on occasion.

Teaching Modes

Students will find that their scheduled teaching time breaks down *approximately* as follows for each year:

1st year: Lectures 55%, Practicals 45%

2nd year: Lectures 55%, Practicals 45%

3rd year: Lectures 60%, Practicals 40%

4th year: Project 50%, Seminars 50%

Students are expected to spend an average of 40 hours a week studying, including the scheduled teaching, so a good portion of students' time should be spent on private study.

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Lectures

Lectures are the principal means by which the course content is delivered to students. Lecturers will generally use lectures to outline the areas of knowledge they wish the student to be familiar with, to emphasise particularly important concepts, and to motivate students in their learning. Attendance at lectures is crucial. Skipping lectures is always a big mistake: even if you copy lecture notes from someone who has attended you may be misunderstanding the notes of someone who has misunderstood the lecture. Lecturers will often supply reading lists to provide you with the means to review subjects covered in the lecture and to help you study a subject in further detail. Lecturers also make extensive use of handouts: commonly these will include complex diagrams or equations. It is good practice to incorporate this material into your lecture notes either by annotation during the lecture or redrafting afterwards. While many lecturers may use powerpoint or other electronic media in their lectures, this is not always the most effective way of explaining concepts or delivering information - and you will find that the ways that lecturers run their classes vary significantly from person to person.

We aim to optimize our teaching to students' needs and to this end students are encouraged to provide feedback on each lecture course. (see example Departmental Questionnaire in Appendix 7).

Practicals

Practical work supplements and extends the lecture courses. Practical problems allow you to determine whether you really understand the content of the lectures; they also give an opportunity for you to develop key skills (e.g. observational or computational) and familiarize yourself with a range of materials that can only be covered briefly in the time available in lectures. Usually the practical work set should be completed within the hours time-tabled for it. However, in some classes you will be expected to complete practical work over a more extended period of time. In some cases, answers to practical exercises may be made available (either at the time, or on WebLearn, or in a later class); but in other practicals you are expected to check your progress with the staff who are running the practical.

In most practicals your work will either be assessed or checked for completeness. Records of completion and the practical work itself will be made available to the examiners who may use it in helping to define borderlines for degree classes.

Independent Reading

Students are expected to supplement all aspects of formal teaching with independent reading in order to obtain a greater understanding of the curriculum as defined in lectures, practicals and fieldtrips. Students can receive guidance from lecturers and tutors, but should also develop an ability to identify relevant subjects, and to navigate effectively through the literature.

There are increasingly large amounts of information available to you via the internet. Although all literature should be approached critically, particular care should be taken with choosing web sources. Lecturers will usually provide suggestions for further reading in their course handouts, and they may also recommend specific web-based resources to support their courses. In many cases, this information will be accessible through WebLearn.

Fieldwork

Teaching in the field works along different lines than in the lecture theatre or practical laboratory. One of the principal early skills that we want you to develop is an ability to make and record your own accurate observations of field phenomena, and to be able to draw scientifically rigorous conclusions from these observations. Good notebook technique is essential to this endeavour: notebooks are not used in the same manner as for lecture notes but will instead often contain accurate labelled drawings and measurements together with essential information about place and time. You may also find it useful to use a notebook to hypothesize on relationships between different field data. Fieldtrip leaders will expect students to show initiative in making their own observations and drawing their own conclusions.

Fieldwork is carried out in all weathers, from intense sunshine to driving rain. You should be properly equipped in terms of clothing for any weather conditions. Essential items include: stout walking boots, rain

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gear (jacket and trousers), cold weather and sunny weather headgear. Additionally, hard hats, reflective jackets and goggles will be issued to you by the department. You must have a sturdy note book of at least A5 size, a x10 hand lens, a geological hammer, a compass clinometer. These items can be bought from the department at cost price, and will be available for purchase at your induction. Please see Elaine Sherrott in room 10.33 if you wish to purchase any items.

To follow University regulations all students must complete a "Permission to Travel Form" (Appendix 2) for the year.

Assessment of Practical work and Fieldwork

Practical classes and field work are an essential component of the course in Earth Sciences, and work completed for practical or fieldwork exercises may be assigned a mark. Candidates in Part A are required to hand in their practical work, field notebooks and any field assignments relating to courses undertaken in their second and third years of study for consultation by the examiners.

Student performance on field trips will be routinely monitored, for example by inspection of field notebooks, and after each field trip students will be graded by the field trip leader on a four point scale (absent/unsatisfactory/satisfactory/excellent). Examiners may take into account these records of practical and fieldwork, in particular with regard to the attendance record of the candidates, and to any marks awarded for assignments, when awarding classes. Material handed in from practical classes will be taken as evidence of attendance.

For candidates whose attendance record is deemed unsatisfactory (for example, candidates who have failed to complete practical and fieldwork classes without good reason), the examiners have the discretion to reduce the final degree class of the candidate. Examiners may also take into account evidence of excellent performance in field or practical work when drawing up class boundaries.

Tutorials

Tutorials provide a flexible forum for small-group teaching, normally in combinations of between two and four students. Tutorials are the responsibility of the colleges, and will usually be arranged by your college tutors. All of the college tutors in Earth Sciences are also academic staff in the department. Tutorials will be given principally by academic staff (often, but not always by, a college tutor), but they may also be conducted by research staff or senior graduate students. The normal frequency of tutorials is on average two to three per week in year one (every first year student should expect to receive one tutorial per week in mathematics, and an average of about two other tutorials per week covering any aspects of the remainder of the course); and two per week in years two and three. There are no formal tutorials in year four, where instead you will receive close project supervision from one or more project supervisors. Note that tutorial provision is the responsibility of the individual colleges, and so specific provisions should be discussed with college tutors.

The principal purpose of tutorials is to allow exploration of a subject beyond the confines set in lectures or by the examinations, and this can be tailored to the specific interests of the students and the tutor. A tutorial also allows the tutors to monitor closely individual academic progress, and hence provide appropriate advice for further academic development. Work set in tutorials can be in a variety of styles. Common modes are: tutorial essays; hand-specimen interpretation; problem sets; focused map interpretation; oral presentations (individual or team work). Tutors will often be happy to modify the work set to suit a particular tutorial group, especially in the later years of study. While information that is considered an essential part of the curriculum is not provided in tutorials (i.e. there are no essential or required tutorials), tutorials are intended to provide greater understanding of the examined curriculum. All tutors fill-out online assessment forms each term that are provided to each student's college and which are used to follow up, and give feedback on, student progress. If you have any concerns of any sort about tutorials, or if you feel that you need tutorials on particular topics, you should contact your college tutor.

Computing

Some courses will make use of the computer teaching laboratory. Generally teaching will involve manipulation of a numerical dataset and interactive comparison of observations with models. As a result you

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should become confident users of spreadsheet software and other data analysis programmes. Additionally lecturers may use the laboratory to develop theoretical concepts.

Seminars

Departmental seminars are held on Friday afternoons at 16.00 during term. These are research seminars in which scientists from a variety of disciplines present and discuss work in their particular fields of interest. This is a good opportunity for you to see how science is really done and **attendance at these seminars is compulsory for fourth year students**. Many third year students will also find these seminars helpful or interesting.

Term Dates

- **Michaelmas Term 2011**
Sunday 9 October to Saturday 3 December 2011
- **Hilary Term 2012**
Sunday 15 January to Saturday 10 March 2012
- **Trinity Term 2012**
Sunday 22 April to Saturday 16 June 2012

University Museum

The Oxford University Museum of Natural History houses the University's scientific collections of zoological, entomological, palaeontological and mineral specimens, accumulated in the course of the last three centuries.

Vacations

The Oxford terms are short and much of the reading that is set during lectures and practicals can only be completed during vacations. This is equally true of Christmas, Easter and Summer vacations, although much of the Easter vacation may also be taken up with field courses. Vacations additionally provide an essential opportunity for you to concentrate on completion of map and research project reports.

WebLearn

Course information, learning support materials provided by lecturers, and other useful information (including this handbook) are accessible through WebLearn, the University's centralised Virtual Learning Environment (<http://weblearn.ox.ac.uk>). It can be reached through any web browser, from anywhere, using the same username and password as for your College email.

WebLearn has recently completed a transition to a new version, and all current materials are accessed via the new portal. However, the old WebLearn (now read-only) can still be accessed by logged-in users through the same portal.

Websites

University website http://www.ox.ac.uk/current_students/index.html

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Department website	http://www.earth.ox.ac.uk/
Programme specifications	http://www.earth.ox.ac.uk/_data/assets/pdf_file/0003/2658/Programme_Specifications_Jan_09.pdf
Subject benchmarks	http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/EarthSciences.asp
Data Protection Guidelines	http://www.admin.ox.ac.uk/councilsec/dp/policy.shtml
Careers	http://www.careers.ox.ac.uk/
The Language Centre	http://www.lang.ox.ac.uk/ to begin and improve foreign language skills.
Computing Service	http://www.oucs.ox.ac.uk/ has many useful computing courses.
WebLearn	http:// weblearn.ox.ac.uk
Equal Opportunities and Harassment	http://www.ox.ac.uk/current_students/equality_health_welfare/index.html
Student Counselling Service	http://www.admin.ox.ac.uk/shw/counserserv.shtml
Departmental Safety website	http://www.admin.ox.ac.uk/safety/hs-mgement-policy
Safety Office	http://www.admin.ox.ac.uk/safety
Occupational Health	http://www.admin.ox.ac.uk/uohs

FIRST YEAR COURSE

Deadlines

Please note:

1. Some of these dates are based on previous years, and may be subject to change. Every effort will be made to notify students of any changes as soon as possible. In the meantime PLEASE PUT THESE DATES IN YOUR DIARY NOW. You may not receive further reminders about some items.
2. These deadlines relate to departmental business, and you may have other important dates relating to college business.
3. Examination and some field trip dates are in italics, as they will be confirmed nearer the time.
4. Deadlines in bold are included in the examination regulations or conventions and you may be penalised by the examiners if you do not meet them. ALL EXAMINATION MATERIAL SHOULD BE HANDED IN TO EMMA BROWN OR THE ADMINISTRATIVE ASSISTANT IN ROOM 10.33.

TERM	WEEK	DAY	TIME	ITEM
Michaelmas Term	Week 0	Friday	2.30-4.30pm	Induction
	Week 0-1	Saturday-Tuesday	09:30 departure	Pembrokeshire field trip
	Week 1	Thursday	11am, 4pm	IT & Library Inductions
	Week 1	Thursday	5.00pm	Welcome Party
Hilary Term	<i>Week 0</i>	<i>Friday</i>	<i>Time TBA</i>	<i>Maths Collections</i>
	<i>Week 0</i>	<i>Saturday</i>	<i>Time TBA</i>	<i>Earth Sciences Collections</i>
Easter Vacation	N/A	TBA	TBA	<i>Arran field trip</i>
Trinity Term	<i>Week 0</i>	<i>Saturday</i>	<i>Time TBA</i>	<i>Maths Collections</i>
	<i>Week 7</i>	<i>Days TBA</i>	<i>Times TBA</i>	<i>Prelims examinations</i>

Field Courses

Pembrokeshire

This four-day field course takes place over a long weekend at the start of the first term, so as to introduce students as soon as possible to the techniques of studying geological features in the field. From the relationships between rocks one can deduce the sequence of events (sedimentation, igneous intrusion, folding and faulting) and so determine the geological history of the area.

The first day is spent at Marloes Bay, and the second around St David's, and the third at West Angle Bay and Tenby. Students learn a range of skills:

- Identifying different types of rock in the field, and deducing what environment they formed in.
- Examining their textural features and structures, and distinguishing those that form at the time of deposition from those that form later.

Using the geological compass-clinometer to measure the orientation of rock strata and other features.

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Assembling all this information on rock type, environment, structure and sequence of events, to determine the evolution through geological time of this part of the Earth's crust.

In the evenings, the day's observations are discussed and brought into the wider context of the geological evolution of Wales.

Arran

The island of Arran, in the Firth of Clyde, is a fascinating outdoor laboratory of geology. Its rock record and landforms reveal most of the geological history of northern Britain from the Late Precambrian to the present day. It is famous for the astonishing variety of its igneous rocks in lavas, dykes, sills and plutons. It lies astride the geological boundary between Scotland's Midland Valley and the metamorphic rocks of the Caledonian mountain belt in the Scottish Highlands.

Here, students learn the fundamental skills of field geology: observing rocks at all scales, recording and measuring field data, and the techniques of geological mapping. Mapping is one of an Earth scientist's most fundamental skills. It comprises the ability to record and interpret the three-dimensional patterns and relationships of rock bodies, and to work out the sequence of events that formed them. As part of the training, students learn:

- to record information in a field notebook: descriptive notes and measurements of thickness, distance, orientation.
- to make detailed and clearly labelled sketches of features seen in outcrop, with interpretation.
- to log sedimentary successions in continuous outcrop and interpret environments of deposition.
- to record outcropping rock types, measurements and other data on field slips - copies of topographic base maps taken into the field. On return from the field, students learn to compile the final version of a geological map from their field slips and recorded data, adding further interpretation in the form of cross sections and an account of the geological history.

Suggested reading

- McKerrow, W.S. & Atkins, F.B. (1989) *Isle of Arran - A Field Guide for Students of Geology*. 2nd ed. Geologists' Association Guide No 32, The Geologists' Association, London. -RL7.
- Nicholas, C.J. (2000) *Exploring Geology on the Isle of Arran*. Cambridge University Press. -3C18.17

Local Geology

These four sessions (half-day) examine geology accessible within the city of Oxford and the Cotswolds, illustrating topics that are covered in the Earth Surface Processes lectures, and allowing students to practice fundamental field mapping and observational skills introduced in previous field excursions.

Week 1: An introductory lecture to the geology of Oxford and the Cotswolds and safety in the field.

Week 2 (half day): This field excursion examines the Corallian limestones formed in the coral reef environments at Rock Edge, Headington, and Wheatley Quarry, giving practical experience of palaeogeography, palaeobiology and interpreting depositional environments.

Week 3 (whole day): Examination of the sediments across the Triassic-Jurassic boundary at Garden Cliff, Westbury-on-Severn, and then the Inferior Oolite Group at Leckhampton Hill, Gloucestershire.

Week 4 (half day): A walk around Oxford examining exotic building stones, and with the aid of cryptic clues reconstructing aspects of the geological history of southern 'super-continent' of Gondwanaland.

Induction

Undergraduate Induction takes place on the Friday afternoon of 0th week and early Michaelmas Term. The purpose of Induction is to introduce students to departmental life as an undergraduate, and to show them

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the facilities on offer. Students will receive briefings from the Head of Department, Undergraduate Advisor, Department Administrator, Computing Officer, and Librarian. This is followed by a welcome party.

"Collections"

Informal examinations, may be taken in the department or in your college. Marks from collections are good indicators of the progress you are making with particular strands of the course: colleges may in some circumstances insist that certain marks are achieved in collections.

Preliminary Examination

These usually take place in Week 7 of Trinity Term.

COURSE STRUCTURE

1st year, 2011-12

Michaelmas Term	Hilary Term	Trinity Term
Planet Earth 24 L TM/DP/SPH/SD/PCE	Planet Earth 24 L ANO/CMN/DMP/HLJ/HCJ	Planet Earth 12 L MDB
<i>Fundamentals of Geology I:</i> Crystals & Minerals 16L + 16P DGF & CMN	<i>Fundamentals of Geology I:</i> Rocks, Minerals & Geological Processes 16L + 16P CMN/SPH	
<i>Fundamentals of Geology II:</i> Geological Maps 16P DJW	<i>Fundamentals of Geology II:</i> Invertebrate Palaeobiology 8L + 16P MDB	<i>Fundamentals of Geology II:</i> 4 half-day field courses MDB
<i>Physics, Chemistry & Biology:</i> Chemistry & Physics 24L TM/ANO/RFK	<i>Physics, Chemistry & Biology:</i> Chemistry & Physics 24L RFK/BEP/ANO/DP/RR	<i>Physics, Chemistry & Biology:</i> Biology 12L HB
Mathematics for Materials & Earth Scientists 16L SB, JB	Mathematics for Materials & Earth Scientists 16L JHW	Mathematics for Materials & Earth Scientists 8L JHW

Fieldtrips:
 Pembrokeshire
 Arran
 Local fieldtrips

Course Synopses and Reading Lists

Books used in each lecture course may be ranked as: Essential (***) ; Useful (**); Supplementary (*). Numbers in **bold type** indicate the shelf-mark of each book. There should be a reference copy of each title in the “Confined Cupboard”. Loan copies will also usually be available and will have the same shelf location. (Check the online catalogue - OLIS - for copies in other libraries). Remember that it is easy to recall books that are out on loan by emailing the librarian.

Further reading (e.g. research papers) will be provided in lectures.

Details of all courses, including reading lists and lecturers, may be subject to change by individual instructors.**The First Year Course**

The first year course is designed to bring all incoming students up the same level of knowledge in the fundamentals of Geology, as well as in the underpinning disciplines of maths, physics, chemistry, and biology, as applied to Earth Science. This is necessary because the Earth Sciences students come to Oxford with a range of A-level subject combinations. Although core science topics are already an important element of the existing first year course, the new arrangements make their inclusion more explicit.

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 **Planet Earth**

**Dr D Porcelli, Prof S Das, Dr T Mather, Professor S Hesselbo, Professor P England, Dr C MacNiocaill, Dr H Jenkyns, Dr H Johnson & Prof M Brasier
Michaelmas, Hilary & Trinity Terms**

A review of key topics in Earth Sciences, including the principal chemical, physical and biological processes operating on the planet today and through Earth history.

- Cox, PA (1989) *The Elements: Their Origin, Abundance, and Distribution*

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 **Fundamentals of Geology I**

**Dr C MacNiocaill, Professor D Fraser & Professor S Hesselbo
Michaelmas & Hilary Terms**

Crystallography, mineralogy, petrology and sedimentology. This course consists of a survey of the important mineral groups and their natural occurrences. It begins with an overview of bonding forces in crystals, the packing of individual atoms and molecules within mineral structures, and the thermodynamic controls on mineral composition and structure. The rest of the course focuses on the systematics of the major mineral groups, incorporating their chemical composition, their crystallographic structures, and where they occur on Earth. Particular emphasis is placed on putting minerals into a geological context; why certain mineral associations occur where they do, both laterally on the surface of the Earth, and vertically down into the crust and the interior of the Earth. Lectures are complemented by practicals where students learn the physical and optical (using petrological microscopes) properties of the common rock-forming minerals, and how to identify them, both in hand specimen and thin-section.

- Nesse, W.D. (1999) *Introduction to Mineralogy*. Oxford University Press

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 **Fundamentals of Geology II**

**Dr D Waters, & Prof M Brasier
Michaelmas & Hilary Terms**

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Geological maps, palaeontology, and field geology.

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Physics, Chemistry & Biology

Dr T Mather, Prof P England, Dr R Katz, Prof B Parsons, Dr D Porcelli, Prof R Rickaby & Dr H Bouman
Michaelmas, Hilary & Trinity Terms

Key basic science skills as applied to Earth Science problems.

- Walker, J., Halliday, D., Resnick, R. (2008) Fundamentals of physics (8th ed.) - **20A.66A**
- Atkins, P., de Paula, J. (2009) Elements of physical chemistry (5th ed.) - **21A.79**
- Kotz, J.C., Treichel, P.M., Townsend, J. (2009) Chemistry and chemical reactivity (7th ed.) - **21.1**
- Alberts, B. ...[et al.] (2010) Essential cell biology (3rd ed.) (also 2nd ed. (2004)) - **6C.11A &B**
- Wallace, J.M., Hobbs, P.V. (2006) Atmospheric science: an introductory survey (2nd ed.) - **1F.24**
- Knauss, A. (2005) Introduction to physical oceanography - **1E.107**
- Denny, M. (2008) How the ocean works: an introduction to physical oceanography - **1E.157**
- Blundell & Blundell, Concepts in Thermal Physics, Oxford University Press, Second Edition.

N.B. There is a copy of each of these books in the Confined Cupboard and also at least one loan copy is available.

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Mathematics for Materials and Earth Sciences

Prof J Woodhouse, Dr S Benjamin & Prof N Marzari
Michaelmas & Hilary Terms

Mathematical methods of general applicability in the physical sciences. Vectors, matrices and determinants, ordinary and partial differentiation, indefinite and definite integrals, complex numbers, Taylor and Maclaurin series, ordinary differential equations.

Suggested Texts:

- Boas, M. (1983) Mathematical Methods in the Physical Sciences. - **9A.37**
- Kreyszig, E. (1999) Advanced Engineering Mathematics (8th ed.) - **9A.99**
- Riley, K., Hobson, M. & Bence, S.J. (2006) Mathematical Methods for Physics and Engineering (3rd ed.). - **9A.97B**
- Stephenson, G. (1973) Mathematical Methods for Science Students. - **9A.28**

SECOND YEAR COURSE

Deadlines

Please note:

1. Some of these dates are based on previous years, and may be subject to change. Every effort will be made to notify students of any changes as soon as possible. In the meantime PLEASE PUT THESE DATES IN YOUR DIARY NOW. You may not receive further reminders about some items.
2. These deadlines relate to departmental business, and you may have other important dates relating to college business.
3. Examination and some field trip dates are in italics, as they will be confirmed nearer the time.
4. Deadlines in bold are included in the examination regulations or conventions and you may be penalised by the examiners if you do not meet them. ALL EXAMINATION MATERIAL SHOULD BE HANDED IN TO EMMA BROWN OR THE ADMINISTRATIVE ASSISTANT IN ROOM 10.33.

TERM	WEEK	DAY	TIME	ITEM
Michaelmas Term	Week 0	Thur 30 Sep - Thur 7 Oct	TBC	Dorset field trip
Hilary Term	N/A	N/A	N/A	Begin to consider mapping area.
Easter Vacation	N/A	TBA	TBA	<i>Assynt field trip</i>
Trinity Term	Week 2	N/A	N/A	Risk Assessment Forms for mapping available
	Week 3	Friday	4.00pm	Submit mapping plan to Conall MacNiocaill.
	Week 4	TBA	TBA	Final approval of mapping area by Mapping Committee
	Week 7	Friday	4.00pm	Submit Risk Assessment Form and insurance form for mapping area to Reception.
	<i>Week 7</i>	<i>Days TBA</i>	<i>Times TBA</i>	<i>2nd Year examinations</i>
	Week 8	N/A	N/A	Mapping cheques available

Second Year

The second year course will go beyond the introductory level and equip students with a more comprehensive knowledge of Earth Sciences topics as well as develop practical skills in observation and data manipulation.

The course will be subdivided into five principal streams: 1) *Deposition and Subsurface Exploration*, which includes Sedimentology and Stratigraphy, Geological Maps, and Geophysical Methods in Geology; 2) *Earth Deformation and Materials*, including Structural Geology, Igneous Processes, and Metamorphic Processes; 3) *Palaeobiology & Palaeoenvironments*, including Sedimentary Petrology, and The Fossil Record; 4) *Geochemistry*, including Carbon Cycle, Stable Isotopes, and Radioisotopes, and; 5) *Geodynamics and Tectonics*.

Cross-cutting these streams will be enabling courses in quantitative problem solving, and elements of mathematics, biology, and chemistry.

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Assessment will be by theory and practical examination in the form of five three-hour papers sat in Trinity Term. The practical examinations will count 40% of the total mark for the second year. All theory papers will be sectioned, and each examination paper cuts across streams, with assessments for streams 1-3 being practical or theory depending on the nature of the material taught.

Field training takes place in Dorset before Michaelmas Term and in Assynt, Scotland, at Easter.

2nd Year Examination, (BA Geology; MEarthSc Part A1)

Two practical papers will take place in teaching laboratories in the Department of Earth Sciences on a single day, and three theory papers will be taken in the Examination Schools - times to be confirmed, but the examination will probably take place in Weeks 7 and 8 of Trinity Term. The class is divided into two groups for the practical papers: in the morning one group writes Paper I, and the other writes Paper II in a separate laboratory. In the afternoon, the groups exchange.

Please note the following for the practical examinations:

- Candidates should ensure that their polarizing microscopes are in good working order. Any that need attention should be left, appropriately labelled, for the attention of The Senior Demonstrator for the Mineralogical Laboratory in good time before the examination.
- Candidates are normally permitted to take a clean copy of Deer, Howie and Zussman Introduction to the Rock-forming Minerals into the petrological paper.

COURSE STRUCTURE

2nd year, 2011-12

Michaelmas Term

Hilary Term

Trinity Term

Structural Geology,
Tectonics
& Remote Sensing
BEP/RW
16L + 16P

Maps
DJW/CMN 16

Geophysical Methods
ANO 16

Rock Structure &
Deformation
RW 8L + 16P

Sedimentology &
Stratigraphy
SPH
9L + 7P

Sedimentary Petrology
HCJ
16L + 16P

Igneous & Metamorphic
Petrology
DMP/MH/DW
16L + 16P

Thermodynamics &
Radiogenic Isotopes
BW/DP
16L + 8P

The Carbon Cycle
GMH 16

Stable Isotopes
RR 16

Mathematical Problem
Solving
for Earth Sciences
MF
16L

Mathematical Problem
Solving
for Earth Sciences
DP
16L

Mathematical Problem
Solving
for Earth Sciences
RK
16L

Evolution
MDB/MF
16L

Fossil Records
MDB/MF
16L

Fieldtrips:
Dorset
Assynt

Course Synopses and Reading Lists

Books used in each lecture course may be ranked as: Essential (***) ; Useful (**); Supplementary (*). Numbers in **bold type** indicate the shelf-mark of each book. There should be a reference copy of each title in the “Confined Cupboard”. Loan copies will also usually be available and will have the same shelf location. (Check the online catalogue - OLIS - for copies in other libraries). Remember that it is easy to recall books that are out on loan using the yellow cards found in the library.

Further reading (e.g. research papers) will be provided in lectures.

Details of all courses, including reading lists and lecturers, may be subject to change by individual instructors.

Earth Deformation & Materials

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Structural Geology, Tectonics & Remote Sensing

Professor B Parsons, Dr R Walker
Michaelmas Term

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Maps

Dr D Waters & Dr. C Mac Niocaill
Hilary Term

In this course students use published and unpublished geological maps at a large variety of scales. Experience is gained in constructing geological cross sections, determining sub-crop patterns, and summarizing the geological history of an area using map information.

Suggested Texts:

- Butler, B.C.M. & Bell, J.D. (1988) Interpretation of Geological Maps. - **1B.24**

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Geophysical Methods

ANO
Hilary Term

An introduction to gravity, magnetic, seismic and electrical methods of geophysical exploration. Instrumentation and field survey design. Data reduction and processing techniques. Geological interpretation of geophysical anomalies. The course includes the acquisition, processing and interpretation of gravity and magnetic data during the Assynt fieldtrip.

Suggested Texts:

- Kearey, P. & Brooks, M. (1991) An Introduction to Geophysical Exploration. (2nd ed.)- **2C.128A** ***
- Lowrie, W. (1997) Fundamentals of Geophysics. - **2C.206** **
- McQuillin, R., Bacon, M. & Barclay. (1979) An introduction to seismic interpretation. **2C.106**
- Merrill, R.T. & McElhinny, M.W. (1983) The Earth’s Magnetic Field. - **2C.137** **
- Mussett, A.E. & Khan, M.A. (2000) Looking into the Earth: An Introduction to Geological Geophysics.- **2C.254**

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- Parasnis, D.S. (1962) Principles of Applied Geophysics. - 2C.48D **

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Sedimentology and Stratigraphy

Prof S Hesselbo
Trinity Term

This course aims to review the principal concepts that underpin much of sedimentary geology. Topics covered include: sedimentary basins; sedimentation and tectonics; facies analysis; downhole geophysical logs; isotope stratigraphy; magnetostratigraphy; cyclostratigraphy and astrochronology; stratigraphic expression of impact cratering; tephra stratigraphy.

Suggested Texts:

- Leeder, M.R. (1999) Sedimentology and sedimentary basins: from turbulence to tectonics.- 26H.340 **
- Reading, H.G. (Ed.) (1996) Sedimentary environments : processes, facies and stratigraphy (3rd ed.)- 26H.119B **
- Brookfield M.G. (2004) Principles of Stratigraphy. - 4A.135**.
- Butler, R.F. (1992) Palaeomagnetism. - 2A.122 **

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Petrology

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Sedimentary Petrology

Dr H Jenkyns
Michaelmas Term

The aim of this course is to provide a basic knowledge of the most important sedimentary rocks from a petrological (rather than a process-oriented or palaeoenvironmental) point of view. As such, it deals with the genesis and diagenesis of clastic, carbonate and chemical rocks and with their classification. Lectures are backed up with practical study, involving thin-section analysis, making of acetate peels, staining techniques for the recognition of calcite, ferroan calcite, ferroan dolomite and dolomite. Students are hence made aware of the dominant grain types, both biogenic and otherwise, that make up carbonate rocks, and the different types of carbonate cement. They also encounter the various cements that occlude porosity in reservoir-type quartz-rich sandstones. Special thin-section sets are available to illustrate these features. Thin-sections of diverse chemical rocks are also available for study. The handouts that accompany the practical part of the course, as well as offering some descriptive information, pose a number of questions that have to be answered after relevant material has been studied.

Suggested Texts:

- Scoffin, T.P. , 1987. An introduction to carbonate sediments and rocks, Blackie.
- Reading, H.G. (Ed.), 1989. Sedimentary environments and facies, 2nd edn. Blackwell Scientific Publications.
- Tucker, M.E. and Wright, V.P., 1990. Carbonate sedimentology. Blackwell Scientific Publications.
- Tucker, M.E., 2001. Sedimentary Petrology, 3rd edn. Blackwell Scientific Publications.
- Blatt, H., 1992. Sedimentary petrology, 2nd edn. Freeman.

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Igneous and Metamorphic Petrology

Dr D Waters, Prof D Pyle,
Hilary Term

The metamorphic section of the course continues the study of metamorphic rocks begun in the first year, and serves as a solid basis for the interpretation of mineral assemblages and textures of metamorphic rocks. Topics covered include: equilibrium and disequilibrium, metamorphic reactions, graphical analysis of phase relations, estimating pressure and temperature of equilibration, inferring P-T-time-deformation histories, metamorphic fluid composition and phase relations, fluid-rock interaction.

The igneous section of the second-year petrology course covers: revision of igneous rocks in hand specimen and thin section. Use of simple phase diagrams to understand the origin and evolution of igneous rocks, including crystallisation and melting paths under equilibrium and fractional conditions. Outline of the main controls on magmatism and magmatic rocks in different tectonic settings.

Suggested Texts:

- Best, M.G. (2003) Igneous and metamorphic petrology.- **26D.123**
- Philpotts, A.R. and Ague, J.J., (2009) Principles of Igneous and Metamorphic Petrology. (2nd ed.) - **26A.79A (Confined Cupboard only)**
- Cox, K.G., Bell, J.D. and Pankhurst, R.J. (1993) The interpretation of igneous rocks. - **26D.67**
- Spear, F.S. (1993) Metamorphic Phase Equilibria and Pressure-Temperature-Time Paths. Mineralogical Society of America. - **26G.51**
- Yardley, B.W.D. (1989) Introduction to Metamorphic Petrology.- **26G.37**
- McBirney, AR (2007) Igneous petrology (3rd.ed) -**26D.89B**

■ **Geochemistry & Ocean Chemistry**

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Thermodynamics & Radiogenic Isotopes

Professor B Wood, Dr D Porcelli
Michaelmas Term

This course covers the use of radiogenic isotope chemistry for geological dating, including methods for determining: the age of the Earth, rock formation and metamorphism ages, early solar system chronology, ¹⁴C ages, exposure ages, the rates of continental growth and planetary degassing, thermal histories of crustal rocks, and the rates of volcanic and environmental processes. Using isotopes for identifying different processes and tracing in the environment and within the Earth is also covered. The thermodynamics part of the course will cover: Thermodynamic functions; chemical potential; free energy; entropy; enthalpy and heat capacity. Hess's law; stable and unstable mineral assemblages. Solid-solid reactions; calculation of simple phase diagrams. Fluids; perfect gas laws; pressure-volume-temperature relationships for imperfect gases; fugacity. Calculations and reactions involving fluids and solids. Activity and standard states; Activity-composition relations for ideal and non-ideal solid solutions. Aqueous solutions; ions and complexes; solubility, Redox potential.

Suggested Texts:

- Faure, G. and Mensing TM (2005) Isotopes: Principles and Applications (3rd ed.) - **25A.68A.**
 - Dickin, A.P. (2005) Radiogenic Isotope Geology, (3rd ed.) - **25A.114A.**
 - Elementary thermodynamics for Geologists by B.J. Wood and D.G. fraser.
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The Carbon Cycle & Stable Isotopes

Prof G Henderson & Prof R Rickaby
Hilary Term

Each session will combine lectured material with hands-on material for the students (calculations, computer exercises, etc). Some will also feature practical demonstrations. The course will occasionally use carbon-isotope data ($\delta^{13}\text{C}$ and ^{14}C).

The course will not use a single text book, but rely on several, on the primary literature, and on web resources.

The course will cover: Introducing the C cycle; The long-term C cycle; The terrestrial biosphere; The ocean biosphere; Inorganic carbon in the ocean; Glacial-interglacial change in atmospheric CO_2 ; The 20th Century; and The future carbon cycle.

Mathematical & Geophysical Tools

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Mathematical Problem Solving for Earth Sciences

Dr R Katz, Dr M Friedman, Dr D Porcelli
Michaelmas, Hilary and Trinity Term

This course will: (i) review basic quantitative tools required for data analysis across the earth sciences; and (ii) provide a working introduction to MATLAB. Major topics to be covered include: probability; statistical testing; parameter estimation; regression models; time-series analysis; ordinary differential equations; Fermi problems; heat equation; wave equation; box models.

Laboratory sessions designed to provide hands-on experience with MATLAB will complement weekly lectures.

Suggested Texts:

Davis, J. C. Statistics and Data Analysis in Geology (2002).

McKillup, S. & Dyar, M. D. Geostatistics Explained: An Introductory Guide for Earth Scientists (2010).

Palaeobiology

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Evolution

Professor M Brasier, Dr M Friedman
Hilary Term

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Fossil Records

Professor M Brasier, Dr M Friedman
Trinity Term

This course will look at the ways in which the fossil record is being used to decode biosphere evolution and environmental change. The course will focus upon methodologies using several recurrent themes throughout the course: Astrobiology and the earliest life, the Cambrian Explosion, extinct fossil groups, and vertebrate

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evolution. Fossil collections in the Museum and Department will be used to illustrate the principles. Topics include: Chaos theory, connectivity and life. Life on Mars. Cladistics, DNA, Molecular phylogeny and Hox genes. Completeness of the fossil record. Disparity versus Diversity. Morphospace analysis and morphometrics: Raupian parameters. Fibonacci and the Golden Number of growth. Biomechanics and functional morphology. Biomineralization and climate. Palaeoecology and evolution. r- and K-strategy. Symbiosis and evolution. The order and selection of these topics may vary.

Suggested Texts:

- Briggs, D.E.G. & Crowther, P.R. (2002) Palaeobiology II.- **5A.229** *
- Davis, P. (1998) The Fifth Miracle.- **5D.75**
- Kemp, T.S. (1999) Fossils and Evolution. - **5A.210** *
- Schopf, J.W. (1992) Major Events in the History of Life.- **5A.159**
- Raup, D. & Stanley, S.M. (1971) Principles of Palaeontology.- **5A.94A**
- Solé, R. & Goodwin, B. (2000) Signs of Life. How Complexity Pervades Biology.- **5A.244**

FIELDTRIPS

Dorset

This six-day field course studies the sedimentary rocks, mostly of Jurassic age, deposited during the development of the Wessex Basin. The rocks are spectacularly exposed in cliff sections along the Dorset coast, and are examined at Lulworth, Osmington, Portland, West Bay (Bridport), Charmouth, Lyme Regis and Axmouth. The focus is on the sediments and the fossils they contain, with a view to interpreting ancient environments and the origin of the sedimentary basin in the context of Mesozoic and Cenozoic earth history.

Also of interest are the geological conditions that led to the formation of oil reserves in this region. In the evenings, time is spent analysing data collected during the day, and learning about related research studies in this area.

Suggested Text:

- House, M.R. (1989) Geology of the Dorset Coast. Geologists' Association Guide. -**RL7 and Dorset Field Trip Box.**



Worbarrow Bay, Dorset. The Late Jurassic to Cretaceous sediments were folded during earth movements related to the Alpine mountain-building.

Assynt

The far north-west of Scotland is an area of classic geology, containing one of the first major overthrust zones to be recognised, and an area of intensively studied Precambrian gneisses widely regarded as a model for the nature of the lower continental crust. The course has a number of objectives:

1. Training in a variety of geological mapping techniques involving a range of rock types and geological settings, including highly deformed rocks and metamorphic terrain, in preparation for students' independent work.
2. An opportunity to link the study and description of rocks in the field with examination of the same rocks in the laboratory.
3. A study of the geological evolution of north-western Britain through about three billion years of Earth history.
4. The acquisition, processing and geological interpretation of gravity and magnetic data.

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Precambrian red sandstones, laid down by river systems 1000 million years ago, make up the bulk of the mountain Quinag.

The principal focus of the course, however, is on recording information, and on the techniques of geological mapping. Mapping is one of an Earth scientist's most fundamental skills. It comprises the ability to record and interpret the three-dimensional patterns and relationships of rock bodies, and to work out the sequence of events that formed them. As part of the training, students learn:

- to record information in a field notebook: descriptive notes and measurements of thickness, distance, orientation.
- to make detailed and clearly labelled sketches of features seen in outcrop, with interpretation.
- to record outcropping rock types, measurements and other data on field slips - copies of topographic base maps taken into the field.
- to make interpretive sketches of the geological features of a large area by making "sky-line cross-sections" from panoramic views.

We learn and practise a variety of mapping techniques:

- Mapping an area of a few square kilometres by visiting essentially all outcrops and tracing out geological boundaries by observation and inference.
- Walking a traverse across a succession of rock types, collecting information for constructing a geological cross-section.
- Mapping well-exposed areas of outcrop in detail by pace-and-compass traverse and grid mapping.
- Logging sedimentary successions in continuous coastal outcrop.
- Mapping and measuring folded and metamorphosed rock sequences, and inferring complex three-dimensional structure.

On return from the field, students learn to compile a final version of the geological map from their field slips and recorded data, adding further interpretation in the form of cross sections and an account of the geological history. The field centre at Inchnadamph provides laboratory space to follow up field observations by studying the rocks of the area in hand specimen and under the microscope.

This course also includes professional instruction on fieldwork safety and survival in remote and rugged terrain.

Suggested Texts:

- Craig, G.Y. (ed.) (1991) *Geology of Scotland* (3rd Ed.), Geological Society of London. - **3B.130**

Or:

- Trewin, N.H. (ed.) (2002) *Geology of Scotland* (4th Ed.), Geological Society of London. - **3B.131** **
- Woodcock, N. & Strachan, R. (eds.) *Geological History of Britain and Ireland*, Blackwell. - **3B.153** **

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Inchnadamph Lodge, the Assynt field centre, looking towards Canisp mountain.



Looking for the unconformity: on the right, banded metamorphic gneisses formed in the deep crust, uplifted, eroded, and locally covered by a veneer of sediment; on the left, shallow-dipping siltstones and sandstones of the 1200 million-year-old Stoer Group, which overlie the gneiss.

Independent Mapping Project

OVERVIEW

All students undertake an independent mapping project during the summer vacation at the end of their second year. The project consists of 4-6 weeks of geological mapping of an area of 11-15 km² in a location of the students' choice. In recent years, students have mapped in areas as diverse as northern and southern Spain, including Mallorca, Elba (Italy), south-east France, Norway, Wales and Scotland.

In addition to mapping, specialised investigations may also be undertaken, involving studies such as structural analysis, petrology, palaeontology, or sedimentology. The mapping area should be reasonably compact and have a sufficient degree of natural or artificial exposure to allow effective mapping at the scale you choose. It should contain distinct and mappable rock-types, and lack large areas of uniform lithology. There should be a sufficient level of stratigraphic or structural complexity to present a challenge. The rocks need not span a wide range of ages: lateral facies variations within a single stage, complex structure, or detailed intrusive and extrusive relations in an igneous centre, could all be suitable for mapping. Areas where recent detailed maps have been published are in general best avoided.

For reasons of safety, you are required to organise yourselves into pairs. Although you will be mapping together during the day, all observations must be marked individually on your field-sheets and the projects will be written up individually. We recommend that in the Hilary term, students start to think about where they would like to map and consult as widely as possible with members of staff about their chosen areas. We also recommend that pairs organise themselves into groups of 4 or more to map adjacent areas. In addition to the mapping, specialised projects may be undertaken, involving detailed field studies such as structural, palaeontological, or sedimentological analyses.

Final approval of the projects takes place in the Trinity term of the 2nd year when each student meets with the mapping committee, currently Dr MacNiocail (Chair), Prof Searle & Dr Waters, who assess the projects in terms of the geological suitability, logistics and, most importantly, safety. In addition, risk assessments are carried out on all the areas.

The aim is to produce

- (i) a field map, normally drawn on a topographic base (aerial photographs may be used as an aid in mapping where available); These should normally be drawn on a topographic base. You may use aerial photographs as an aid in mapping. If a topographic base is unavailable, you may construct a base from aerial photographs (subject to the panel's approval). If the only available topographic base does not include contours, then you should make some attempt to show the topography.
- (ii) a field note-book(s). This should be a sturdy hard-backed notebook, and be kept tidy and legible. Grid-references or other information should be included to allow notes to be keyed to your maps. Field sketches should have scales and orientation.
- (iii) structural sections and sedimentological logs. These should be drawn up as far as possible while you are in the field area.
- (iv) a collection of representative rock specimens, (about fist-sized and as fresh as possible) from which thin sections may be prepared, and photographs of outcrops and landscapes to supplement field sketches.
- (v) In the report on the mapping project the student's main task is to explain clearly the geology of their area, taking reasonable account of previous literature. At the same time they have to show they have done a good job in the field, and can interpret their observations both critically and imaginatively, and with good scientific sense: no easy matter!

Students will be given a cheque for £400 towards the cost of their Summer Mapping (£300 subsistence and £100 travel). Cheques will be available for collection from Reception during eighth week of Trinity Term.

Students may also apply to the Roger Walling Fund for an additional £100 towards their mapping costs - details will be circulated in Trinity Term.

Students must have travel insurance regardless of their destination. This can be as part of a family scheme, bought independently or via the University Scheme (which currently costs £15 for 30 days cover). Students

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must hand in an insurance application form or a photocopy of their insurance document along with their risk assessment form.

If mapping work is the UK, please check requirements for insurance with the Elaine Sherrott, the Administrative Assistant.

In exceptional cases, if it is impossible for a student to undertake a field project, e.g. for health and safety or disability reasons, an alternative laboratory-based project can be arranged. However, the terms of the accreditation of the degree course by the Geological Society of London include a requirement that students undertake a period of independent field work, and it is not usual practice for students not to complete a field project.

BEFORE TRAVELLING - A CHECKLIST

- (i) Attend the talk on safety in the field (you will need to sign a form to show that you have done so).
- (ii) Complete the Independent fieldwork risk assessment form (see and discuss your plans, in depth, with the Field Teaching Officer - Dr. MacNiocaill, who will be particularly concerned with safety. The panel will want to be assured that you are aware of potential hazards in the area, and that you have planned suitable control measures to reduce risks to an acceptable level.
- (iii) Demonstrate that you have suitable clothing and footwear and other necessary equipment.
- (iv) Collect the safety pack loaned by the Department (against a deposit), consisting of a helmet, safety glasses, whistle, survival bag, torch, and emergency rations. In addition, it is highly desirable to have a mobile telephone, though they may not always work in remote mapping areas. Also collect other documentation (safety information, addressed envelope, names and telephone numbers of members of the department who can be contacted while you are in the field).
- (v) Hand in the information sheet, giving details of the precise location of your mapping project, the names of all members of your group, where you are planning to stay and any points of contact, and the dates of your field work, and also a preliminary assessment of likely hazards in the mapping area.
- (vi) In addition, you are strongly advised to discuss your plans widely, especially with your College tutor and anybody close to you (family, friends etc.) - this way you will be able to take into account a wide range of experience and points of view before going to your mapping area.

IN THE MAPPING AREA

- As a group undertake a reconnaissance of each mapping area. Use your initial reconnaissance to update your risk assessment. Record in your field notebook any amendments to the nature and severity of hazards and how you plan to address these hazards to minimise the risks.
- Return the addressed envelope with your updated address, dates of mapping, and any new information about potential hazards in your mapping area. If you don't feel confident about working in the area at this stage, you should take appropriate and sensible action. Use your common sense - you are ultimately responsible for your project, including your own safety in the field.
- In the same place as the rest of the group, exchange information each day, and inform a local independent party (hostel guardian, policeman, shopkeeper) where you plan to map and what time you expect to return.
- Further notes on mapping technique (<http://www.earth.ox.ac.uk/~conallm/MappingNotes>) are also available.
- **The Department will allow for up to 10 thin-sections to be prepared for you, so collect samples with this in mind. If you have carbonate rocks, you may also be able to make your own acetate peels for microscope investigations.**

HANDING IN THE PROJECT

Students are expected to cut their own samples, in preparation for the creation of thin sections, at the beginning of the Michaelmas term of their 3rd year. The samples will be sent to the Open University, and thin sections returned in Week 8 of Michaelmas Term.

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The completed field mapping project should be submitted to Emma Brown in Room 10.33, by 12 noon on Thursday of Week 0, Hilary Term.

To facilitate distribution among the examiners, the report and all field materials must be contained in a SINGLE STANDARD BOX FILE.

The Examiners will normally award about 50% of the marks for the record of work done in the field, i.e. as recorded in notebooks and on field slips.

THIRD YEAR COURSE

Deadlines

Please note:

1. Some of these dates are based on previous years, and may be subject to change. Every effort will be made to notify students of any changes as soon as possible. In the meantime PLEASE PUT THESE DATES IN YOUR DIARY NOW. You may not receive further reminders about some items.
2. These deadlines relate to departmental business, and you may have other important dates relating to college business.
3. Examination and some field trip dates are in italics, as they will be confirmed nearer the time.
4. Deadlines in bold are included in the examination regulations or conventions and you may be penalised by the examiners if you do not meet them. ALL EXAMINATION MATERIAL SHOULD BE HANDED IN TO EMMA BROWN OR THE ADMINISTRATIVE ASSISTANT IN 10.33.

TERM	WEEK	DAY	TIME	ITEM
Michaelmas Term	Week 1	TBC	TBC	Cut rock samples for thin sections to be prepared.
	Week 1	Friday	1.00pm	Hand in cut rock samples to Emma Brown in 10.33.
	Week 3	N/A	N/A	3 rd year essay approval forms available
	Week 6			Begin to consider 4 th year project topics, and approach supervisors if appropriate.
	Week 8	TBA	N/A	Thin sections available for collection
	Week 8	Friday	N/A	Return essay approval form
	Week 8	N/A	N/A	Collect mapping questionnaire, for inclusion with mapping project.
	Hilary Term	Week 0	Thursday	12.00 noon
Week 1		N/A	N/A	Briefing on 4 th year projects. A list of supervisors and some suggestions for projects will be available on WebLearn .
Week 5		Friday	4.00 pm	Submit application for research project.
Easter Vacation	N/A	TBA	N/A	<i>Spanish field trip</i>
Trinity Term	Week 0	Thursday	12.00 noon	Hand in 3rd year essay (<u>TWO copies</u>) to Emma Brown in 10.33
	Week 5	Days TBA	Times TBA	<i>Part A examinations</i>

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	Week 6	Monday	N/A	Hand in all practical material to Emma Brown in 10.33
	Week 7	Tuesday & Wednesday	TBA	Interviews with External Examiner
	Week 7	Wednesday	4.00pm	Finals Photo
	Week 9	Friday	4pm	Finals Party

Independent Mapping Project

THIN SECTIONS

Students are expected to cut their own samples, collected during the summer mapping exercise, and the rock slices will then be sent away for the preparation of thin sections. Arrangements for rock cutting will be notified in Week 0 of Michaelmas Term, and you must hand in your cut rock samples to Emma Brown, Academic Administrator, in room 10.33 by 1.00pm on Friday of Week 1. The Department will allow for up to 10 thin-sections to be prepared for you.

HANDING IN THE PROJECT

The completed field mapping project should be submitted to Emma Brown in Room 10.33, by 12 noon on Thursday of Week 0, Hilary Term.

To facilitate distribution among the examiners, the report and all field materials must be contained in a SINGLE STANDARD BOX FILE. The submitted material should consist of

(a) the final report, (consisting of the final map and cross sections, an account of geological setting, lithologies, stratigraphy, structure, synthesis, references, etc.) should be self-contained, i.e. it should be intelligible without reference to the field materials. The report is strictly limited to 6000 words in length; students should provide a **word count** confirming this. Lithological and petrological descriptions should be integrated into the body of the report, not attached in appendices.

(b) all field materials such as notebooks, field slips, cross sections and structural analysis performed in the field,

(c) all thin sections.

The Examiners will normally award about 50% of the marks for the record of work done in the field, i.e. as recorded in notebooks and on field slips.

Third Year Essays

As part of the third year course, students complete an essay on a substantial scientific problem of their choice that is sufficiently unresolved to allow scope for critical evaluation and independent thought. The topic should be refined in discussion with a member of staff. The extended essay is understood by the examiners to be an independent piece of work and written according to the structure and style of a review paper. For example, see the "information for authors" for the journals: Earth Science Reviews:

http://www.elsevier.com/wps/find/journaldescription.cws_home/503329/authorinstructions

and the Journal of the Geological Society:

http://www.geolsoc.org.uk/gsl/publications/author_instructions

These provide suggestions of the style, presentation and layout which are appropriate for this essay.

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Third year essays are entirely independent, and no tutorials may be provided nor any input given by the tutor beyond initial definition of the subject area.

The examiners will reward very clearly written essays that assimilate existing information and demonstrate critical skills, familiarity with and understanding of a significant amount of primary literature, originality, and well-argued independent thought.

Approval forms, available from Emma Brown in room 10.33, should be returned by Friday of 8th week of Michaelmas Term.

The arrangements for approving essay titles and for regulating the amount of interaction with members of academic staff are laid down by the Faculty's Academic Committee.

The completed essay **must not exceed 4000 words** (excluding references, figure captions, text in diagrams, and tables). Students must provide an accurate word count. Note that figure captions should only include directly relevant explanatory text. Inclusion of marginally relevant figures and tables should be avoided. **Two copies of the essay** should be submitted to Emma Brown in Room 10.33, by **12 noon on Thursday of Week 0, Trinity Term.**

Third Year Examination (BA Geology; MEarthSc Part A)

The third year course will allow a degree of specialization within Earth Sciences sub-disciplines, and at the same time will continue to develop core skills and knowledge. There are also two substantial pieces of formally assessed independent work - a literature review and a field-mapping project.

Subject matter will be grouped into options. Students chose three out of five options in Michaelmas Term, and three out of five options in Hilary Term. In addition the Spanish Field trip and associated short lecture course will be compulsory. Options will be timetabled in either Michaelmas Term or Hilary Term to allow students to pursue a programme of study that covers a coherent grouping of subjects.

The third-year (Part A) examination consists of seven written half-papers (six out of ten options plus fieldwork paper) and two pieces of independent work. In addition, marks from the second-year examinations are carried forward. Entry to the Part A examination is handled through the colleges.

■ Examinations

The written examinations are usually scheduled for Week 5 of Trinity Term. The compulsory fieldwork paper may contain practical material and may require the use of polarizing microscopes. Any that need repair or adjustment should be left, appropriately labelled, for the attention of Jeremy Hyde for the Mineralogical Laboratory in good time before the examination. The fieldwork paper will take place in the Department, and the remainder in the Examination Schools. Further details of the topics to be examined in each paper are published by the Finals Examiners during the year. Sample papers will be provided, as a guide to the format and content.

■ Submission of Practical Materials

Candidates in Part A are required to submit their practical notes and field notebooks relating to courses undertaken in the second and third years of study for consultation by the examiners. The usual practice is for these notes to be deposited in the Lower Laboratory on the Monday of Week 6 of Trinity term, i.e. after completion of the written examinations. They can be collected after the final examiners' meeting, normally in Week 7.

■ Meetings with the External Examiner

All candidates are required to take part in small group meetings with the External Examiner during his/her visit to the Department, normally early in week 7. The examiner will seek feedback on the course as a whole.

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Publication of Results

Public lists of exam results are no longer formally published by the University, but marks are made available to tutors as soon as possible after the final meeting of the examiners. This is normally towards the end of week 7. Those intending to graduate with the BA (Geology) are given a classified result at this stage. Those continuing to Part B of the MEarthSc are not classified, but may obtain a breakdown of their marks from their tutor.

Student must achieve a nominal classification of at least a 2.2 to proceed to 4th year.

COURSE STRUCTURE

3rd year, 2011-12

Each student takes 6 half papers, 3 from each term, plus 1 fieldwork paper

<p>Michaelmas Term Students choose 3 out of 5</p>	<p>Hilary Term Students choose 3 out of 5</p>	<p>Trinity Term Revision</p>
<p>Sedimentary Basins ABW 16</p>	<p>Natural Resources LR/DJW/DP 8/4/6 SPH tba 6</p>	
<p>Biological Oceanography & Sea Level HB/GMH/SPH 24</p>	<p>Physical Oceanography & Palaeoclimate HJ/RR/GMH 24</p>	
<p>Seismology & Earth Structure JHW/SD 12</p>	<p>Volcanoes & Environment DMP/TM 12</p>	
<p>Continental Deformation PCE 12</p>	<p>Igneous Processes & Petrogenesis DMP 12</p>	
<p>Earth Materials, Rock Deformation & Metamorphism DJW/DGF 24/4</p>	<p>Evolutionary Turning Points MDB 12 Vertebrate Palaeobiology MF 12</p>	
<p>Geophysical & Mathematical Methods SD/BP 12/12</p>	<p>Geodynamics JHW/RK 12/12</p>	

Fieldtrips:
Spain

Third Year Course Synopses and Reading Lists

Details of all courses, including reading lists and lecturers, may be subject to change by individual instructors.

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Paper 1. Sedimentary Basins

Prof Tony Watts
Michaelmas Term

The aim of this course is to discuss some of the geophysical processes that are operating in the Earth's outer layers in the present and through geological time. The focus here is on the evolution of sedimentary basins: the fundamental thermal and mechanical processes that control their "architecture" and the sedimentary processes that determine the nature of their fill. The following topics are covered: sediment loading and unloading; flexure and sediment delivery and infill; elastic thickness and its relationship to plate and load age; aggradation and the steer's head model; progradation and the clinoflexure model; yield strength envelope models; cyclothem and time-dependent flexure; Airy and flexural backstripping; thermal contraction and uplift; lateral heat flow; uniform and non-uniform extension models; orogenic loading; surface and buried loads; yoking, encroachment and inheritance; relative control of tectonics and sea-level changes on the nature of the stratigraphic record; dynamic topography; forward stratigraphic models and the prediction of thermal history and petroleum play. Practicals provide opportunities for developing computer skills in the modelling of basin flexure, tectonic subsidence and uplift, and crustal structure.

Suggested Texts:

- Fowler, C.M.R. (2005) *The Solid Earth: An Introduction to Global Geophysics*. (2nd ed.) - **2C.169**
- Turcotte, D.L. & Schubert, G. (2002) *Geodynamics: Applications of Continuum Physics to Geological Problems*. (2nd ed.) - **2C.136A**
- Watts, A.B. (2001) *Isostasy and Flexure of the Lithosphere*. (Especially Chapters 4, 6 & 7.) - **2C.257**

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Paper 3. Biological Oceanography and Sea Level

Dr H Bouman, Prof S Hesselbo & Prof G Henderson
Michaelmas Term

Biological Oceanography

Dr H Bouman

This course aims to explore some of the basic principles of biological oceanography. The course will explore the relationship between the physicochemical properties of the marine environment and planktonic communities, including phytoplankton, bacteria, and zooplankton. The use of in situ and satellite observations to study the spatial and temporal patterns in the distribution and abundance of marine organisms will be explained through both lectures and practical demonstrations. The role of ocean biota in global biogeochemical cycles will also be discussed.

Sea Level and the Stratigraphic Record of Sea Level Change

Prof S Hesselbo & Prof G Henderson

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This course will assess the processes that control sea-level, the impact of sea level on Earth surface systems, and our approaches to the reconstruction and prediction of sea level. It will deal with a diverse range of timescales, from millions of years to modern and future changes.

The course will examine the response of a variety of sedimentary systems to changes in relative sea-level, including analyses made on the basis of simple physical and geometrical models, and observations on sedimentary cycles in seismic reflection profiles, boreholes, and outcrop. The possible contributions of tectonic processes, sediment supply, and eustatic sea-level changes will be discussed. Consideration will be given to the changing palaeoclimatic context of sea-level changes through Earth history, and the varying importance of different processes through geological time. Concepts of sequence stratigraphy and their application to predict facies changes will be introduced.

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Paper 5. Geophysics

Seismology and Earth Structure

Prof S Das & Prof J Woodhouse
Michaelmas Term

Review of rays in a spherical earth (ray parameter, takeoff angle). Proof of Snell's law.

Reflection & refraction of elastic waves at plane boundaries: use of scalar and vector potentials, boundary conditions, expressions for and evaluation of reflection and refraction coefficients for particular cases.

Variation of amplitude with distance (including derivation of relevant expressions, if time permits) and importance of travel time curves.

State of stress at subduction zones, mid-ocean ridges and continental collision zones. The seismic cycle; properties of foreshocks and aftershocks. Earthquakes along the Nankai trough and the San Andreas fault. Variation of slip along faults.

Global Earth Structure.

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Continental Deformation

Prof P England
Michaelmas Term

L 1. Statement of the Problem: How do the tectonics of continents and oceans differ, and why?

L 2 & 3. Measurement of continental deformation: earthquakes, geodesy, field geology

L 4 & 5. Heat Flow: Metamorphism, Sedimentary Basin Formation, Dissipation on Faults

L 6. Rheology of continental lithosphere

L 7 Kinematic Models: Microplates, Blocks, and how to calculate their motions

L 8 Mechanical Models: Driving forces: how to get stress into the interior of plates

L 9 Mechanical Models: Equations for creeping flow of continents

L 10 Active Tectonics of Asia

L 11 Active Tectonics of the Eastern Mediterranean

L 12 Active Tectonics of western North America

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Paper 8. Earth Materials, Rock Deformation and Metamorphism

Dr D.J. Waters & Prof D Fraser
Michaelmas Term

Rock Deformation

Dr D.J. Waters

This series of lectures and practicals examines the way rocks and crystalline aggregates deform. It concentrates on ductile processes occurring at the scale of the mineral lattice and the grain boundary region. These processes are important for our understanding of the behaviour of the Earth's crust and mantle, and are reflected in the microstructures developed in geological materials. The course has, therefore, a large practical component in which students learn to identify and interpret microstructures of intracrystalline deformation, recrystallisation and fabric development. The aim is to reconstruct the tectonic evolution of rock bodies, scaling up to the orogenic belt.

Four sessions, each consisting of a lecture and two hours of practical work, cover:

- Principles: strain measurement and geometry, ductile deformation at the lattice scale, dislocation creep, recovery and recrystallisation.
- Review of deformation mechanisms at the lattice and grain scales. Mechanism maps, role of temperature and strain rate. Shear zones: geometry, fabrics, kinematics, shear-sense indicators.
- Fabric development in tectonites: foliations and lineations; controls on grain size; case studies of fabrics and deformation patterns from accretionary wedges to the deep crust and mantle.
- Interplay between deformation, mineral reaction and mass transfer. Interpreting sequences of deformation and mineral growth. Himalayan case study: the South Tibetan Detachment System.

Suggested Texts:

- Passchier, C.W. & Trouw, R.A.J. (1996, 2005). *Microtectonics*.- 2A.86, 2A.86A

Metamorphic Geology

Dr D.J. Waters

This course consists of six sessions of lectures and illustrative practical work that build on earlier courses and deal with the contribution of metamorphic studies at a range of scales to an understanding of tectonics and crustal evolution. A wide range of topics is covered, including:

- The thermal budget of crustal regimes, isograd patterns, P-T paths and exhumation processes in collisional orogeny, with examples mainly from the Alps. (Sessions 1-2)
- Metamorphism in subduction zones, ultra-high pressure metamorphism, density changes, metastability and the fate of subducted material. Transitions from subduction to collision to exhumation. (Sessions 3-4)
- Metamorphism on high thermal gradients: melting in the crust, migmatites and melt segregation processes; granulites and their associations, e.g. magmatic arcs, extensional zones, Precambrian shields and the lower crust. (Sessions 5-6)

Suggested Texts:

There is no text book as such, but a brief reading list of journal articles and review papers will accompany each session.

Mineralogy of Earth's Interior

Prof D Fraser

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■ **Paper 9. Geophysical & Mathematical Methods**

Prof S Das & Prof B Parsons
Michaelmas Term

Vector Calculus (Prof Das)

Review definition of scalars and vectors, dot and cross products and their physical meaning. Triple products. Scalar and vector fields. Differentiation and integration of a vector function. Line and area integrals. Interchanging the order of integration. Volume integrals. Spherical and cylindrical polar coordinates. Connectivity of regions. Taylor's theorem for more than one variable. Green's theorem in a plane.

Definition of the gradient of a scalar (grad). Grad and its properties. Physical meaning of grad. Conservative fields. Definition of divergence (div). Physical meaning of div. Definition of the Laplacian. Definition of curl. Potentials. Equivalence of irrotational and conservative. Suffix notation. Combinations of grad, div and curl. Application of grad, div and curl to products of functions. Divergence (or Gauss's) theorem. Physical meaning of curl. Stokes' theorem. Rotation of axes. Statement of Helmholtz theorem (w/o proof, as it is needed in 4th year seismology).

Suggested Texts:

- Kreyszig, E. (1999) *Advanced Engineering Mathematics* (8th ed.) - 9A.99
- Matthews, P.C. (1998) *Vector Calculus*.- 9A.106
- Riley, K.F., Hobson, M.P. & Bence, S.J. (1998) *Mathematical Methods of Physics and Engineering*.- 9A.97

Thermal & Mechanical Models of the Lithosphere (Prof B Parsons)

L1-2. Subsidence and heat flow at mid-ocean ridges; the error function solution to the heat diffusion equation; Fourier sine series solution for a cooling plate; a thermal model for sedimentary basin formation.

L3-4. The earth's gravity field; the gravitational potential and Laplace's equation; a simple solution of Laplace's equation; attenuation of gravity anomalies with height; the relationship between geoid heights and gravity anomalies; deriving marine gravity fields.

L5-6. Observations of flexure for the oceans and continents; the one-dimensional flexural equation; response of an elastic plate to surface loads; isostatic gravity anomalies.

L7-8. Surface displacements across faults; dislocations; equilibrium in an elastic medium; simple dislocation model of a strike-slip fault.

There will also be weekly Matlab practical exercises to illustrate and expand on material from the lectures.

Books:

- Fowler, C.M.R. (2005). *The Solid Earth: An Introduction to Global Geophysics*, 2nd edition, Cambridge University Press. (2C.169) Chapters 5,7
- Turcotte, D.L. & Schubert, G. (2002). *Geodynamics*, 2nd edition, Cambridge University Press. (2C.136A) Chapters 3,4,5

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■ **Paper 2. Natural Resources**

Prof L Robb, Dr D Waters, Dr D Porcelli & Prof S Hesselbo
Hilary Term

Subsurface Mapping and Petroleum Geology

Professor SP Hesselbo to organise

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This programme will include lectures from external speakers working in the petroleum industry.

Suggested Texts:

- Coe, A.L. (ed.) (2003) *The Sedimentary Record of Sea-Level Change*. - **4A.124**
- Kearey, P. & Brooks, M. (1991 or 2002) *An introduction to geophysical exploration*. (2nd or 3rd ed.)- **2C.128A or B**
- Rider, M.H. (1996, 2002) *The Geological Interpretation of Well Logs* (2nd ed. or 2nd ed. rev.)- **24C.86A**
- Sheriff, R.E. & Geldart, L.P. *Exploration seismology*. (2nd ed.) (Chapters 5, 11 & 12 only.) - **2C.253**
- Selley, R.C., (1998), *Elements of Petroleum Geology*. (2nd ed.) -**24C.54A**
- Gluyas, J. and Swarbrick, R. (2007) *Petroleum Geoscience*. -**24C.107**

Mineral Deposits and their Settings

Prof L J Robb & Dr D J Waters

Part 1 - An Introduction to Ore-Forming Processes

- Magmatic processes: crystal fractionation and partial melting with applications to mafic and granitophile ores; formation of chromite seams; sulphide immiscibility in mafic magmas, concentration of incompatible trace elements in magmas.
- Hydrothermal processes: basic principles; magmatic-hydrothermal fluids, porphyry copper-molybdenum deposits; other fluid types, solubilities of metals in hydrothermal solutions, precipitation mechanisms. orogenic (or lode-gold) and volcanogenic massive sulphide (VMS) deposit types.
- Sedimentary processes: introduction to placer deposits and hydraulic sorting mechanisms.

Part 2 - Global Tectonics and Metallogeny

- The origin and evolution of the continents in the Precambrian; secular and cyclic changes in crustal tectonics and the environments of ore deposition.

Suggested Texts:

- Robb, L.J. (2004) *Introduction to Ore-forming Processes*. - **24A.103**

Groundwater Resources

Dr. D Porcelli

This course will also examine the fundamental principles of groundwater flow, the occurrence and flow of groundwater in various geological settings, and the rates of replenishment and discharge. The factors controlling the chemistry of groundwater will also be considered, including the migration of chemical constituents and contaminants. Problem sets will involve considering how groundwater flow patterns are determined and how groundwater flow rates and contaminant migration rates are calculated.

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Paper 4. Physical Oceanography and Palaeoclimate

Dr H Johnson, Prof G Henderson & Prof R Rickaby
Hilary Term

Physical Oceanography

Dr H Johnson

This course aims to explore some of the basic principles of physical oceanography. The course will build on material covered in Planet Earth to explore in more detail the physics governing ocean circulation and the role that the oceans play in global climate. Both the depth-integrated wind-driven circulation and the

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abyssal circulation will be discussed in terms of vorticity equations. The possibility of multiple equilibrium solutions for the Atlantic meridional overturning circulation will be introduced. Techniques used to observe ocean currents will also be presented.

Palaeoclimate

Prof Gideon Henderson & Prof R Rickaby

The course will start with an investigation of Pleistocene sea-level changes associated with glacial-interglacial cycles and abrupt millennial climate change. It will detail the largely geochemical techniques for reconstruction of sea level in this timeframe, the role of ice-sheets in controlling sea level, and the role that sea level plays in global and regional climate. The course will continue to an overview of sea level change in the last century, including issues such as tide gauge interpretation and isostatic effects. And we will finish with a forward look at likely and extreme scenarios for sea level rise of the future.

Throughout the course, relationships between sea-level change and other key aspects of the Earth system such as the carbon cycle will be addressed. The course will be lecture based, and supported by practicals to reinforce major points and examine case studies.

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Paper 6. Volcanoes and Igneous Petrogenesis

Prof David Pyle & Dr Tamsin Mather

Hilary Term

Volcanoes and Environment

Prof David Pyle & Dr Tamsin Mather

This 12-hour course will provide an understanding of the ways in which volcanoes can erupt, the products of various types of eruption and the environmental and climatic impacts of eruptions. Lectures and practicals in this course will cover the following topics: styles, sizes and scales of eruptions; physical properties of magma and physics of explosive eruptions; identification of volcanic rocks in hand specimen; solubility and degassing of volatiles; atmospheric effects of volcanic aerosols and gaseous products. Case studies of particular eruptions will be used to illustrate the course.

Most of the recommended reading for the course will be from published papers from the literature, for which reading lists will be handed out at the time. Other texts which either give some appropriate background to parts of the course, or are collections of relevant research papers, include:

Textbooks.

- Cas & Wright (1988) Volcanic Successions - Modern and Ancient. - 26E.92
- Francis, P. and Oppenheimer, C. (2004) Volcanoes - A Planetary Perspective. - 26E.86A
- Marti, J and Ernst, G (2005) Volcanoes and the environment. - 26E.99
- Sigurdsson (ed.) (2000) Encyclopedia of Volcanoes. - Reference Shelf
- Sparks et al. (1997) Volcanic Plumes. - 26E.91 (Confined Cupboard only. Out of print. + 1 RSL Openshelf)

Monographs

- Bebout, G.E. et al (editors, 1996). Subduction : top to bottom. AGU Geophysical Monograph 96. 2A.88
- Eiler, J. (editor, 2003). Inside the subduction factory. AGU Geophysical Monograph 138. 2A.128 (Confined Cupboard)
- Robock, A and Oppenheimer, C (editors, 2004). Volcanism and the Earth's Atmosphere. AGU Geophysical Monograph 139. 26E.100

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Igneous Processes and Petrogenesis

Prof David Pyle

This course focuses on the formation and evolution of magmas, focussing in particular on magmatism in subduction zones. In lectures and practicals, you will revisit the origins of mafic magmatism at ocean ridges and in continental rifts, before exploring how petrological, geochemical and physical constraints can be brought together to develop an understanding of the factors that control subduction-related magmatism on Earth. The course will also consider in detail a couple of case studies.

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Paper 7. Palaeobiology

Vertebrate Palaeobiology

Dr M Friedman
Hilary Term

This course will review evolutionary history of vertebrate animals as illuminated by the fossil record. Beginning with the closest living and fossil relatives of vertebrates, we will review major anatomical innovations including the origin of the skeleton, the evolution of jaws, the transition to land, and the origin(s) of flight. Apart from exposure to extinct and living vertebrate biodiversity, students will receive training in the methods applied by palaeontologists in addressing evolutionary questions. Lectures will be augmented by laboratory sessions designed to provide hands-on experience with vertebrate fossil specimens.

Suggested Texts:

- Benton, M. J. *Vertebrate Palaeontology* (numerous editions).
 - Carrol, R. L. *Vertebrate Paleontology* (1988).
 - Radinsky, L. B. *The Evolution of Vertebrate Design* (1987).
 - Jollie, M. *Chordate Morphology* (1962).
- (free download on: <http://www.archive.org/details/chordatemorpholo00joll>)

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Evolutionary Turning Points

Prof M Brasier
Hilary Term

This course will explore major turning points in the history of the biosphere in deep time. Each lecture will focus upon a key geological deposit, to dissect its wider geological and evolutionary context, its significance for the fossil record, and the latest techniques and ideas for interpretation. 1, The 3460 Ma Apex chert - geological contexts for the origins of life. 2, the 3400 Strelley Pool chert - decoding the earliest cellular assemblages. 3, the 1900 Ma Gunflint chert - contexts for the origins of eukaryote cells and organelles. 4, the 1000 Ma Torridon phosphate - exploring the origins of life on land. 5, the 570 Ma Mistaken Point biota - contexts and debates for the origins of animals. 6, the 520-510 Ma Chengjiang and Burgess Shale biotas - context and debates for the Cambrian explosion (linking to the Vertebrate course). Most lectures will be accompanied by a practical involving study of relevant living organisms, and access to our own remarkable early life collections. Seminar topics on new analytical techniques will include: molecular phylogeny; biomarkers; nanoSIMS mapping; laser Raman, FIB TEM, and synchrotron.

Suggested Texts

- Brasier, M.D. *Darwin's Lost World*. OUP. (for lectures 4-6) (2009).
- Fedonkin, M. et al. *The Rise of Animals*. John Hopkins (for Ediacara biota and Cambrian) (2008)

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- Knoll, A. Life on a Young Planet. Princeton (for whole course) (2003)
- Schopf, J.W. Cradle of Life. Princeton (for first three lectures) (1999).
- Selden, P. and Knudts, J. Evolution of Life. (for lectures 3-6) (various editions)

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Paper 10. Geodynamics

Prof J Woodhouse & Dr R Katz
Hilary Term

This course will cover the fundamental observations and theories that inform our understanding of the dynamics of the mantle on geological time-scales. It will include a discussion of the static structure of the mantle, constraints from seismic tomography, an introduction to fluid mechanics and the principles of convection, and a discussion of advanced topics relevant to mantle convection.

L1-3 (JHW): Static density structure of the Earth; Adams-Williamson equation; seismically derived elastic properties; moment of inertia, phase transitions and discontinuities.

L4-6 (JHW): Observational constraint on geodynamics; seismic tomography; structure of the lithosphere and upper mantle; structure of the lower mantle, D".

L7-12 (JHW): Introduction to fluid mechanics; stress-strain; viscosity; laminar flow; canonical problems; gravity currents; post-glacial rebound;

L13-16 (RFK): Introduction to convection; Rayleigh-Taylor instability; Rayleigh-Benard convection problem; Rayleigh number; convection experiments.

L17-20 (RFK): Mantle convection; boundary-layer steady-state theory; Nusselt-Rayleigh scaling; convection and plate tectonics, mantle rheology and deformation mechanism.

L21-24 (RFK): Advanced topics: heat budget of the Earth; chemical geodynamics; convection in other planets; plume theory; magma/mantle interaction at plate boundaries.

FIELDWORK

 Spain

This trip is running for the first time in 2011-12. Details to be confirmed.

Fourth Year Research Projects

In the 4th year, students carry out a research project under the supervision of a member of the Academic staff. The purpose of the project is to introduce students to scientific research first hand. In most cases, students work as part of a team on a topic that may involve laboratory work, computation, or fieldwork. The projects suggested include those of a geological, geochemical and geophysical nature, and may also be of a theoretical or an observational character. You are encouraged to suggest projects of your own based on your aptitudes and interests. Your suggested potential projects should be discussed with appropriate members of staff or your tutor at an early stage. The timetable for project allocation is outlined below.

Students should start to give some thought to project areas and potential supervisors by the beginning of Hilary Term. During **Week 1 of Hilary Term** a member of the Faculty will give a brief introduction to the process of choosing a project, and the nature of project work (etc), in a 1 hour timetabled presentation. At this meeting, students will be introduced to general information about the sorts of projects that are available across the department, and of projects that have recently been completed. All of this information

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will also be made available on **WebLearn** - including a listing of Faculty and the areas in which they offer projects. Reports of past projects can also be found in the library, and former students are also valuable sources of information about project areas and potential project supervisors.

The definition of a research project is first and foremost the responsibility of the student. Students should submit the application form (which will be provided early in Hilary Term) to the Academic Administrator by the **end of Week 5 of Hilary Term**. This proposal should have been discussed with, and nominally approved by, the potential supervisor(s) - but this does not imply that the project will be approved by the Academic Committee. Students should usually submit more than one choice, ranked in order of preference. Any students experiencing difficulty identifying project areas should discuss this with their college tutor at an early stage.

The Academic Administrator and Chair of Academic Committee will then vet the proposals, and projects will be allocated according to the students' preferences as far as possible, but subject to the proviso that no individual supervisor will have a load of more than 2 full projects (or equivalent). We will endeavour to inform students of their project allocation by **Week 8 of Hilary Term**. For most projects, this will leave plenty of time for planning and seeking financial support (e.g. for projects involving fieldwork).

Students who wish to use work completed on summer placements towards a project will be able to do so. In examples where summer placements are not firmed up until later in Hilary or Trinity terms, the students should nonetheless submit an application with as much detail as possible.

An updated list of possible projects suggested by staff should be available for circulation by the beginning of Hilary Term.

Decisions about what places are available are *not* made on a first come first served basis. Supervisors usually try to match aptitude, enthusiasm and specific ability to the projects proposed.

FOURTH YEAR COURSE

Deadlines

Please note:

1. Some of these dates are based on previous years, and may be subject to change. Every effort will be made to notify students of any changes as soon as possible. In the meantime PLEASE PUT THESE DATES IN YOUR DIARY NOW. You may not receive further reminders about some items.
2. These deadlines relate to departmental business, and you may have other important dates relating to college business.
3. Examination and some field trip dates are in italics, as they will be confirmed nearer the time.
4. Deadlines in bold are included in the examination regulations or conventions and you may be penalised by the examiners if you do not meet them. ALL EXAMINATION MATERIAL SHOULD BE HANDED IN TO EMMA BROWN OR THE ADMINISTRATIVE ASSISTANT IN ROOM 10.33.

TERM	WEEK	DAY	TIME	ITEM
Hilary Term	Week 7	N/A	N/A	Begin to organise 4 th year mini conference
Trinity Term	Week 1	TBA	<i>TBA</i>	4 th year mini conference
	Week 1	Friday	N/A	Submit first draft of 4 th year project to supervisor
	Week 2	Friday	N/A	Supervisor to return draft project to student
	Week 3	Thursday	2.00pm	Hand in 4th year project to Emma Brown in room 10.33
	<i>Week 4/5/6/7</i>	<i>Date TBA</i>	<i>Time TBA</i>	<i>Project viva with project markers</i>
	<i>Week 8</i>	<i>Dates TBA</i>	<i>Times TBA</i>	<i>Part B examinations</i>
	Week 8	Thursday	4.00pm	Hand in pdf copy of project on disk to Emma Brown in room 10.33
	<i>Week 9</i>	<i>Monday & Tuesday</i>	<i>TBA</i>	<i>Vivas with External Examiner</i>
	Week 9	Friday	4pm	Finals Party

Fourth Year Examinations

Candidates must have achieved the equivalent of a minimum 2.2 classification in Part A in order to proceed into 4th year and Part B.

The fourth-year examination (Part B) consists of four theory papers, normally chosen from eight optional subjects, and an advanced practical project or extended essay, written up as a dissertation. The deadline for examination entry is set in the middle of Hilary Term, to allow candidates to make a considered selection of the options offered in Hilary Term.

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■ Written Examinations

The written part of the Part B examination consists of eight two-hour papers, of which candidates have chosen four. They generally take place in the Examination Schools during Week 8 of Trinity term.

■ Interview

All candidates have an informal interview of about 25 minutes duration with the External Examiner during his/her visit to the Department, normally early in week 9. The examiner will speak to the student regarding their 4th year project and examination papers. This provides additional information for assessing the overall achievement of each candidate.

This interview is distinct from the project viva, which the student has with the two internal markers of their 4th year project. Further details of this may be found below in the section on the 4th year project.

■ Publication of Results

Results are published, and marks made available to tutors, as soon as possible after the final meeting of the examiners. This is normally towards the end of week 9.

Fourth Year Research Projects

In the 4th year, students carry out a research project under the supervision of a member of the Academic staff. The purpose of the project is to introduce students to scientific research first hand. In most cases, students work as part of a team on a topic that may involve laboratory work, computation, or fieldwork. You should already have been allocated a project and supervisor before the end of your 3rd year.

Responsibility for the project lies with the student; and you should be proactive in seeking support and guidance as you complete your project. **If you experience any problems with your project at any point, please ensure you discuss this with somebody as soon as possible. If you feel unable to approach with your supervisor, please contact your tutor, the Undergraduate Advisor, or one of the academic administration team.**

■ Supervision and training

Students should expect to have regular contact with their supervisor(s) over the course of the project, with more intensive support being usual in the initial and final stages of the project. Students should discuss the pattern of project supervision with their supervisor(s) at an early stage of the project. The support given by supervisors in meetings, or by email, may include formal discussion of research, feedback on the student's writing, analysis of results and direction to the relevant literature, as well as discussions of anything else needed for the investigations to progress smoothly. Further support will be given in the techniques required for the student to carry out their research including, for example, training in software, use of equipment, and so on. Students should note that (i) it is in the nature of research that not all projects will require the same type or level of support and (ii) for some projects the supervisor will personally deliver specialist training, whilst for others training and advice may be provided by technical staff, or researchers associated with the research area. Students should also note that access to and use of departmental facilities (e.g. the SEM, etc) will often require advance booking, and discussion with the appropriate technical or research staff. Students are encouraged to discuss their likely requirements with their supervisors, and plan their work accordingly.

Formal supervision of the project ends at the end of week 1, with the submission of the draft project to the lead supervisor. After this point, the only feedback on the project will be the one-page review by the supervisor; it is the responsibility of the student to complete the final revisions to the project.

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The project write up

The essay/project, should be double-spaced with a font size no smaller than 12 pt, should be accompanied by relevant references, tables and illustrations. This report should accurately and comprehensively describe the project, and normally would include the following:

- 1) An abstract
- 2) A concise description of the scientific background to the project
- 3) Aims and objectives
- 4) Experimental and data-collection procedures
- 5) Description of results
- 6) Interpretations of the results and analysis of their implications
- 7) A statement of conclusions
- 8) Identification of any information or data used as part of the project but originating from other individuals or organizations
- 9) A reference list

Appendices should be used principally for presenting supplementary information that does not form a central aspect of the project.

Students must adhere to an 8000-word limit for the essay/project (excluding references, figure captions, text in diagrams, and appendices). Note that figure captions should only include directly relevant explanatory text. Inclusion of marginally relevant figures and tables should be avoided. **An accurate word count must be included, along with a signed statement that the project is your own work.**

A complete draft of the project must to be handed to the lead supervisor for formal feedback by the end of Week 1 of Trinity Term at the latest. The supervisor will return this draft along with any comments to the student by the end of Week 2. Comments will be restricted to one A4 page, 12 point font. If the supervisor is likely to be away/on leave during Week 2, the student and supervisor should make alternative arrangements well in advance. The lead supervisor will also submit to the examiners a one page report on the amount and nature of supervision given to the student, by the end of 2nd week.

The final version of the project will be marked by two people in the Department, neither of whom will be the supervisor of the project.

The two internal markers will be allocated after submission of the project. A viva, conducted by the two markers, will be a formal part of the process of marking the dissertation. This viva will take place between Weeks 3 and 7 of Trinity Term, that is after the final project report has been submitted, and before commencement of the written examinations. The viva will be usually last between 30 minutes and 1 hour, and will be a discussion of the project material by the candidate and the two markers. It will be an opportunity for the markers to explore the depth of a student's knowledge of their project, and also to discuss the conduct, science, and background of the work.

Please note that the project viva is distinct from the informal interview with the external examiner.

4th year students informal presentation to their peers (the "Mini Conference") may takes place during of Week 1 Trinity Term.

Three copies of the final version of the project must be submitted to Emma Brown in room 10.33 by 14.00 on Thursday of 3rd Week of Trinity Term of the 4th year. Students should retain a fourth copy of the project for their own use.

Students are also requested to provide a pdf copy of their project on disk by 4pm on Thursday of Week 8 of Trinity Term. If you have any problem producing this, please contact the Academic Administration Assistant.

After marking, two copies will be deposited in the library of the Department of Earth Sciences, and the third copy given to the supervisor. Current practice is for the Department to reimburse the cost of binding (**SOFT** binding only) one library copy on presentation of a receipt to Mrs Yasuko Nakajima in the Accounts Office.

Students will be invited to provide feedback on their projects.

COURSE STRUCTURE

4th year, 2011-12

Each student takes 4 papers, plus 4th year project.

Michaelmas Term Students usually choose 2 out of 4	Hilary Term Students usually choose 2 out of 4	Trinity Term Revision
Option 1 Planetary Chemistry BW/DGF 16	Option 2 Rock, Environmental & Palaeomagnetism CMN 16	
Option 3 Topics in Volcanology DMP/TM 16	Option 4 Anatomy of a Mountain Belt MPS 16	
Option 5 Seismology JHW/SD 16	Option 6 Palaeobiology MDB/MF 16	
Option 7 Major Environmental Change HCJ/CMN/RR/SPH 16	Option 8 Topics in Oceanography GMH/RR/HJ/HB 16	

Fieldtrips:
Greece/Bermuda (optional)

Fourth Year Course Synopses and Reading Lists

Books used in each lecture course may be ranked as: Essential (***) ; Useful (**); Supplementary (*). Numbers in **bold type** indicate the shelf-mark of each book. There should be a reference copy of each title in the “Confined Cupboard”. Loan copies will also usually be available and will have the same shelf location. (Check the online catalogue - OLIS - for copies in other libraries). Remember that it is easy to recall books that are out on loan by emailing the librarian. Further reading (e.g. research papers) will be provided in lectures.

Details of all courses, including reading lists and lecturers, may be subject to change by individual instructors.

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 **Planetary Chemistry**

Prof B Wood
Michaelmas Term

The course will examine, through a mixture of lectures, group discussions and student presentations, the processes involved in solar system formation and the establishment of the large-scale chemistry of the Earth. Topics will include solar nebula condensation, growth of planets, timing of Earth formation and segregation of the core, evolution of Mars, formation of the moon, redox state of the Earth, and the distribution of water within the Earth.

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 **Topics in Volcanology**

Prof D M Pyle & Dr T A Mather
Michaelmas Term

This course will focus on a range of current problems in volcanology, through a series of eight 2 - hour seminars. The first 2-hour session will provide an introduction to the course, and will cover some introductory material. For each of the following weeks we shall pose a question, which will set the theme for the papers under discussion. Everyone attending the course will be expected to read 4 papers each week. The first of these will be either a recent review or overview paper, or one that presents the “current” consensus view. The other three papers will present more specific view points on the subject and will be the focus of the student-led seminars and discussion. Topics that we shall cover will include the atmospheric and environmental impacts of volcanic emissions and hazard, risk and predictability of eruptions.

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 **Seismology**

Prof J Woodhouse & Prof S Das
Michaelmas Term

Quantification of Earthquakes: Earthquake stress drops; fault dynamics and rupture speeds; effect of fault heterogeneity on seismograms; Earthquakes as indicators of tectonic strain; the use of synthetic seismograms in determining the seismic moment tensor and other source characteristics; the centroid moment tensor technique. Structural Seismology: Ray theory and ray tracing in heterogeneous media.

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Surface waves and free oscillations and the calculation of theoretical seismograms; inverse problems in seismology; techniques of seismic tomography.

Suggested Texts:

- Aki, K. & Richards, P.G. (1980, 2002) Quantitative Seismology (1st or 2nd ed.) - **2C.264 (2 vols.), 2C.265**
- Scholz, C.H. (2002) The Mechanics of Earthquakes and Faulting (2nd ed.) - **2C.154A**
- Udías Vallina, A. (1999) Principles of Seismology - **2C.222**

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Records of Major Environmental Change in Earth History

Dr C MacNiocaill, Dr H Jenkyns, Prof S Hesselbo & Prof R Rickaby
Michaelmas Term

This option considers the nature and causes of major perturbations and transitions in the Earth's environmental systems. The course is run principally as a seminar series in which all students will have an opportunity to discuss key papers on particular topics, often a single major event. Typical topics covered include glaciations, hyperthermal events, effects of large-scale igneous processes, and mass extinctions and other major biotic changes.

Suggested Texts:

- Courtillot, V. (1999) Evolutionary Catastrophes: The Science of Mass Extinction - **5A.219 ****
- Drury, S. (1999) Stepping Stones: The Making of Our Home World - **7A.60 ****
- Huber et al. (eds). (2000) Warm Climates in Earth History - **4C.29 ****
- Poag, C.W. (1999) Chesapeake Invader: Discovering America's Giant Meteorite Crater - **26J.50 ***

.....

Environmental, Rock and Palaeo-Magnetism

Dr C MacNiocaill
Hilary Term

The magnetic record in rocks and minerals carries information that can be used to study problems in a very diverse range of geological, environmental and archaeological fields. This course will cover the fundamental physics that underpins the technique, and will use case studies to illustrate the application of the technique. These may include:- the dynamics of Earth's magnetic field; the fundamentals of rock and mineral magnetism; studies of climate change through magnetic properties of sediments and soils; the emplacement temperatures and transport dynamics of pyroclastic flows; aspects of continental deformation and terrane migration; and plate motions, the fixity of hotspots and geodynamic reference frames.

Suggested Texts:

- Butler, R.F. (1992) Paleomagnetism (particularly chapters 2, 3 & 8 (pp. 187-203) available online at course website) - **2A.122 *****
- Dunlop, D.J. & Ozdemir, O. (1997) Rock Magnetism. - **2C.220 *****
- Tarling, D.H. (1983) Palaeomagnetism: Principles and Applications in Geology, Geophysics and Archaeology (particularly chapters 2, 3 & 4). - **2C.275 ****

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Anatomy of a Mountain Belt

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Prof M Searle & Prof A Watts
Hilary Term

This course will cover long-term, geological processes involved in the creation of mountain belts, mainly along the Alpine - Himalayan chain. Continent - ocean (or island arc) collision zones as exemplified by the Oman Ophiolite, early continent - continent collision, as exemplified by the Zagros ranges, Iran, and later continental collision, as exemplified by the Himalaya and Tibetan plateau will be used as the main examples. Processes discussed will include: ophiolite origin and emplacement, mantle - crust processes in oceans and ophiolites, deep subduction of continental crust, crustal shortening and thickening processes, development of oil and gas traps in thrust belt forelands and flexural foreland basin development. The course will also cover deeper crustal processes during collision, including: inverted metamorphism, crustal melting and granite emplacement, thrust and normal faulting in compressional mountain belts, middle - lower crustal flow in the Himalaya and Eastern Tibet. Mechanisms of formation and uplift of the Tibetan Plateau will include discussions on the role of continental extrusion and large-scale strike-slip faulting (eg: Karakoram, Altyn Tagh, Red River faults), and the role of crustal thickening and timing of surface uplift. The course will consist of 8 weeks of lectures, practicals and a final seminar series in which students will present talks on a specific aspect of the course, or based on recent research papers.

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Palaeobiology: Fossil Controversies

Prof M Brasier, Dr M Friedman
Hilary Term

Topics will address major current debates and controversies in the fields of Palaeobiology and Astrobiology. Topics include: Life on Mars. The origins of life on Earth. The emergence of life on land in the Precambrian. Decoding the Ediacaran Enigma. Palaeozoic lagerstätten. Arthropod evolution and Palaeozoic biogeography. Dinosaur palaeobiology, evolution and the origin of birds. Hominid origins and evolution. Neandertals and the origin of anatomically modern humans. The order and selection of these topics may vary.

Suggested Texts:

- Boulter, M. (2002) Extinction and the End of Man - **5D.64**
- Beard, K.C. (2004) The Hunt for the Dawn Monkey - **5B.59 ***
- Knoll, A.H. (2003) Life on a Young Planet - **5D.69**
- Parsons, K.M. (2001) Drawing out Leviathan - **5B.60**
- Schopf, J.W. (1992) Major Events in the History of Life - **5A.159**
- Schopf, J.W. (1999) The Cradle of Life - **5D.53**
- Shipman, P. (1998) Taking Wing - **5B.61**
- Tattersall, I. (2000) Becoming Human: Evolution and Human Uniqueness - **5D.71 ***

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Topics in Oceanography

Prof G Henderson, Prof R Rickaby, Dr H Bouman & Dr H Johnson
Hilary Term

In a series of eight two-hour student-led seminars, this course will cover:

- Ocean de-oxygenation
- Role of trace metals in the carbon cycle
- Ocean acidification
- Sea-level
- AMOC and its role in the climate system

FIELDWORK

Bermuda

This trip is a pre-sessional and optional course for a limited number of students. Future plans for this field trip will depend on the availability of external sponsorship.

Greece

This trip is a pre-sessional and optional course for a limited number of students. This is running for the first time as a 4th year fieldtrip in 2011-12, and future plans will depend on how successful this trip is.

The Greek field course is mainly concerned with active geological processes, providing several aspects of training not otherwise available in the field programme. One aim is to demonstrate the importance of an integrated geological study that makes use of geophysical and geochemical data, and evidence from sediments and fossils, to build up a picture of active deformation of the continental crust. The course focuses on two related investigations:

1. An active volcano, Santorini, in the Aegean Sea.
2. Active faulting and its effect on sedimentation in the Gulf of Evvia and Gulf of Corinth regions.



The island of Nea Kameni - the site of active volcanism in the centre of the present Santorini caldera. This island is visited by boat during the field course in order to see very recently erupted volcanics, and ongoing hydrothermal activity.

Days 1 to 3 are spent on Santorini, examining the great variety of eruptive rock types, and the details of the volcanic sequences related to major eruptions. Evening exercises include using field data to calculate the duration and volume flux of the Minoan eruption. We also see the destructive power of the eruption at the Minoan excavations in Akrotiri.



The Minoan deposits at Oia. The Minoan eruption deposited up to 10 metres of volcanic deposits, initially as air-fall, but then as hot pyroclastic flows, about 3600 years ago. This eruption entirely wiped out civilization on the island, and may well have played a significant role in the collapse of the Minoan civilization centred on Crete.

Days 4 to 10 are spent on the mainland of Central Greece. We begin in the Locris area, at the north end of the Gulf of Evvia. We learn about the pattern of faulting related to extension of the crust, its control on sedimentation, and the sequence of faulting through time, by observing features of the landscape around Kamena Vourla, Kallidromon, and Parnassos. We then move South to the Gulf of Corinth, stopping on the way to visit the active faulting near Thebes, including the 1981 Plataea-Kaparelli fault scarps. The Gulf of Corinth preserves a variety of sediments deposited during its evolution, and in particular reveals the interplay between movements of the crust and sea-level change.

Suggested Texts:

- Cas & Wright (1988) Volcanic Successions - Modern and Ancient. - **26E.92** ***
- Sparks et al. (1997) Volcanic Plumes - 26E.91 (Confined Cupboard only) (Out of print) **



At the fault face. This large fault surface in limestone, at Arkitsa, close to the south coast of the northern Gulf of Evvia, was revealed when scree covering it was excavated for use in road construction. The fault surface shows prominent striations and corrugations, the orientation of which show an oblique sense of movement associated with the rotation of crustal blocks necessary to accommodate the overall deformation in the region. There is a discoloured band between the excavated fault surface and the vegetation above, which may represent the slip that occurred in the most recent earthquake.

Please note that you will need some money for food during this field trip: you should allow approximately ten Euros per day for this.

APPENDICES

Appendix 1 - Class Descriptors & Examining Conventions

Guidance criteria for marks awarded to assessed work in Earth Sciences is provided overleaf.

Marks	Descriptor for WRITTEN ANSWERS	Descriptor for PROBLEMS	Descriptor for PROJECT ESSAYS
90% - 100%	Outstanding: full of insight; exceptional command of material; well organized with introduction, critical discussion and conclusions.	Formulation of the problem and choice (or derivation) of relevant equations show complete understanding; all assumptions and logical steps are clearly explained. Algebraic manipulation and/or calculations are without error.	Outstanding and original; well organized with clearly stated aims that are wholly realized; logical; critical analysis of wide range of data and literature; excellently presented and illustrated.
80% - 90%	Excellent answer; well structured and sound; evidence for both a wide knowledge and understanding of subject; goes well beyond lectures; effective grasp of literature and debate, effective critical analysis.	Formulation of the problem and choice (or derivation) of relevant equations show excellent understanding; nearly all assumptions and logical steps are clearly explained. Algebraic manipulation and/or calculations have little or no error.	Original; very well written and illustrated; thorough review of own data and thorough command of published literature; effective critical analysis; logical; strong intellectual input.
70% - 80%	Good to very good understanding of the issues; well written and well illustrated; evidence for integration of outside reading into course material; clear ability to make connections across the course; some critical analysis.	Formulation of the problem and choice (or derivation) of relevant equations show good to very good understanding; the principal assumptions and logical steps are clearly explained. Algebraic manipulation and/or calculations are without substantial error.	Well written and clearly structured; shows a good to very good understanding of the arguments; efficient use of data and relevant literature; some critical analysis; good intellectual input into design and course of project.
70% - 60% +	Competent; sound to good understanding of presented course material; coherent and reasonably illustrated; limited ability to make connections across the course. Small factual errors and /or omissions may be present.	Formulation of the problem and choice (or derivation) of relevant equations show sound to good understanding; the principal assumptions and logical steps are explained. There may be small errors in algebraic manipulation and/or calculations.	Competent; database and literature base adequate to good; coherent writing and good presentation; some input into design and course project. Some omissions in discussion and/or minor errors in understanding.

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<p>60% - 50%+</p>	<p>Answer based largely on lecture material; should be presented within an adequate framework. May not make connections across the coursework. Little detail or signs of originality. Large and small factual errors</p>	<p>Formulation of the problem and choice (or derivation) of relevant equations show adequate understanding; some assumptions are not stated, and there are gaps in the logic of the calculation. Errors in algebraic manipulation and/or calculation lead to incorrect or incomplete answers.</p>	<p>Pedestrian treatment of wide literature or data; or inadequate treatment of incomplete literature or data. Little or no intellectual input. Writing competent but lacks critical appraisal.</p>
<p>50%- 40%+</p>	<p>Based entirely on lecture material. Unstructured. Numerous errors. No connections made across coursework. Concepts disordered or flawed; many factual errors.</p>	<p>Formulation of the problem and choice (or derivation) of relevant equations show inadequate understanding. Assumptions are not stated, and there is little or no logic of the calculation. Errors in algebraic manipulation and/or calculation lead to unrealistic answers, or to no answer.</p>	<p>Approach basic, shallow, narrow. Poorly presented. Lack of understanding. Misguided selection of material. Lack of background material. Flawed arguments. Conclusions flawed or lacking.</p>
<p>40%- 0%</p>	<p>Significant inability to tackle the question. May answer an imaginary question.</p>	<p>Significant inability to tackle the question. May answer an imaginary question. Problem formulation non-existent. Incorrect or irrelevant formulae used; little or no calculation.</p>	<p>No adherence to project or essay outline or title. Little evidence of understanding the topic.</p>

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**Finals Structure For Current 3rd & 4th YEARS ONLY (1st & 2nd Years see next page)
Weighting of Papers and Marks in Part A and Part B**

Year	Exam	Weighting	Percentage of Final degree classification
Part A1 (2 nd year)	Paper 1 (Practical)	50	
	Paper 2 (Practical)	50	
	Paper 3 (Geology)	50	
	Paper 4 (Geophysics)	50	
	Paper 5 (Geochemistry)	50	
Subtotal		250	-13.9%
Part A2 (3 rd year)	Paper 1 (Fieldwork)	50	
	Paper 2	50	
	Paper 3	50	
	Paper 4	50	
	Paper 5	50	
	Paper 6	50	
	Paper 7	50	
Subtotal		350	-19.4%
	Independent Essay	100	-5.6%
	Mapping Project	200	-11.1%
Subtotal (A2)		650	
TOTAL:		900	50%

The marks from the second-year examination are brought forward from the previous year. Those taking the three-year B.A. (Hons) will have their degree awarded on the basis of the above marks.

The weightings for Part B are as follows (100 = standard written paper):

Year	Exam	Weighting	Percentage of Final degree classification
4 th	Theory 1	100	
	Theory 2	100	
	Theory 3	100	
	Theory 4	100	
Subtotal		400	25%
	4 th Year Project	400	25%
TOTAL:		800	50%

The final MEarthSc degree is based on a final mark derived by averaging the final percentages of Part A and Part B, i.e. Parts A and B are equally weighted. Classification of the degree is guided by the class divisions summarised below, but also takes into account the interview conducted with the External Examiner, and the practical work deposited by the candidates.

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Finals Structure for current 1st & 2nd Years ONLY (3rd & 4th Years see previous page)

Weighting of Papers and Marks in Part A and Part B

Year	Exam	Weighting	Percentage of Final degree classification
Part A1 (2 nd year)	Paper 1 (Practical)	40	
	Paper 2 (Practical)	40	
	Paper 3 (Geology)	40	
	Paper 4 (Geophysics)	40	
	Paper 5 (Geochemistry)	40	
Subtotal		200	-20%
Part A2 (3 rd year)	Paper 1 (Fieldwork)	~36	
	Paper 2	~36	
	Paper 3	~36	
	Paper 4	~36	
	Paper 5	~36	
	Paper 6	~36	
	Paper 7	~36	
Subtotal		250	25%
	Independent Essay	50	5%
	Mapping Project	100	10%
Subtotal (A2)		400	
TOTAL:		600	60%

The marks from the second-year examination are brought forward from the previous year. Those taking the three-year B.A. (Hons) will have their degree awarded on the basis of the above marks.

The weightings for Part B are as follows:

Year	Exam	Weighting	Percentage of Final degree classification
4 th	Theory 1	50	
	Theory 2	50	
	Theory 3	50	
	Theory 4	50	
Subtotal		200	20%
	4 th Year Project	200	20%
TOTAL:		400	40%

The final MEarthSc degree is based on a final mark derived by summing the final percentages of Part A and Part B. Classification of the degree is guided by the class divisions summarised below, but also takes into account the interview conducted with the External Examiner, and the practical work deposited by the candidates.

PERMISSION TO TRAVEL APPLICATION FORM



Fieldtrips Oct 2011 - June 2012

Weymouth - 26th September - 2nd October

Pembroke - 31st October - 2nd November

Arran - 15th - 23rd April

Castellane - TBA

Greece - TBA

Mendips - TBA

Half Day Fieldtrips - June

Risk Assessment approved by: John Woodhouse Date: / /

Signature of Student : _____ Date: / /

Name:

Address:

Countersigned by
Administrator

 / /

Date:

Please ensure that you have either your own personal insurance cover for your personal items or the University travel insurance and contact information:
<http://www.admin.ox.ac.uk/finance/insurance/travel/>.

If travelling abroad, take a copy of your passport, tickets and other important travel documents and store safely.

Appendix 3 - TRAVEL INSURANCE

TRAVEL INSURANCE APPLICATION FORM



Prior to completing this application form you are asked to please read the following:

Your travel insurance document provides cover for both you and your personal belongings while travelling on University business. Details of the limits of cover are set out on the Confirmation of Travel Insurance policy, which your departmental administrator will hand to you before your departure. However for the personal belongings element of your insurance you are kindly asked to note the following:

1) Your personal belongings are covered for their loss, theft or damage (maximum payable £1,000), however there will be a deduction of £50 (an excess) in respect of each claim that you make. This will be netted-off against any compensation that might be payable.

2) We strongly advise you not to take valuable items with you while travelling, however if this is unavoidable, and if you have to make a claim, it must be supported by a Police Report if the item is lost or stolen, or by a bona fide estimate of repair if damaged. Such an estimate must also record the extent of the damage, the cost of repair if appropriate and the value if it is to be written-off. You must also be able to produce, if asked to do so, either a receipt for the item(s) carried or a bona fide estimate of value and this information must pre-date your period of travel.

3) Items with a value in excess of £500
 You must list below all items you will be taking with you when travelling, which have an individual value in excess of £500 per item. In the event of a claim involving such expensive personal items, you must again provide with your claim a Police Report if the item is lost or stolen, as well as a receipt or an estimate of value, which predates the period of travel.

Name: _____

Address: _____

Department/Club/Society: _____

Travel Destination (Country/City/Town) _____

Reason for Travel: _____

Risk Assessment Approved by _____

Dates From: / / **Dates To:** / /
Maximum period of cover is 6 months

List of Personal Items with value > £500	Est Value
_____	£ _____
_____	£ _____
_____	£ _____
_____	£ _____

Signature of Applicant : _____ **Date:** / /

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N.B. cover will operate from this date and is important for the cancellation element of the insurance

Countersigned by

Administrator

(For departmental travel only)

Date: / /

Appendix 4 - A QUICK GUIDE TO STAFF 2011-12
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Academic Staff List**Head of Department** – Professor John Woodhouse (Head.of.Department@earth.ox.ac.uk)

Name	Post	Rm	Tel. No.	Email Address
Heather Bouman	Lecturer	30.04	72019	Heather.Bouman@earth.ox.ac.uk
Martin Brasier	Professor of Palaeobiology	30.07	72074	Martin.Brasier@earth.ox.ac.uk
Shamita Das	Professor in Earth Sciences	30.05	72015	Shamita.Das@earth.ox.ac.uk
Don Fraser	Professor of Earth Sciences	20.09	72033	Donald.Fraser@earth.ox.ac.uk
Matt Friedman	Lecturer	40.11	72035	Matt.Friedman@earth.ox.ac.uk
Gideon Henderson	Professor of Earth Sciences	40.07	81123	Gideon.Henderson@earth.ox.ac.uk
Steve Hesselbo	Professor of Stratigraphy	50.10	72029	Stephen.Hesselbo@earth.ox.ac.uk
Hugh Jenkyns	Lecturer	40.08	72023	Hugh.Jenkyns@earth.ox.ac.uk
Helen Johnson	Lecturer	50.05	72142	Helen.Johnson@earth.ox.ac.uk
Richard Katz	Lecturer	40.10	82122	Richard.katz@earth.ox.ac.uk
Conall MacNiocaill	Lecturer	40.09	82135	Conall.MacNiocaill@earth.ox.ac.uk
Tamsin Mather	Research Fellow	40.05	82125	Tamsin.Mather@earth.ox.ac.uk
Barry Parsons	Professor of Geodesy	50.06	72017	Barry.Parsons@earth.ox.ac.uk
Don Porcelli	Lecturer	50.09	82121	Don.Porcelli@earth.ox.ac.uk
David Pyle	Professor in Earth Sciences	30.06	72048	David.Pyle@earth.ox.ac.uk
Ros Rickaby	Lecturer	40.06	72034	Rosalind.Rickaby@earth.ox.ac.uk
Mike Searle	Professor in Earth Sciences	50.08	72022	Mike.searle@earth.ox.ac.uk
Richard Walker	Research Fellow	40.13	72014	Richard.walker@earth.ox.ac.uk
Dave Waters	Lecturer	Mus.	82457	Dave.Waters@earth.ox.ac.uk
Tony Watts	Professor of Marine Geology & Geophysics	30.12	72032	Tony.Watts@earth.ox.ac.uk
Bernie Wood	Research Professor	30.10	72014	Bernie.wood@earth.ox.ac.uk
John Woodhouse	Professor of Geophysics	50.12	72021	John.Woodhouse@earth.ox.ac.uk

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Name	Post	Rm	Tel.	Email Address
COMPUTING STAFF				
May Chung	IT Systems Administrator	50.14	82136	May.Chung@earth.ox.ac.uk
Steve Usher	IT Systems Administrator	50.14	82110	Stephen.Usher@earth.ox.ac.uk
LIBRARY STAFF				
Elizabeth Crowley	Librarian	10.07	72050	Eliaizabeth.Crowley@earth.ox.ac.uk library@earth.ox.ac.uk
ADMINISTRATIVE STAFF				
Emma Brown	Academic Administrator	10.33	72043	Emma.Brown@earth.ox.ac.uk
Gill Halstead	Departmental Administrator	10.31	72007	Gill.Halstead@earth.ox.ac.uk
Sue Ling	Departmental Secretary	10.30	72030	Sue.Ling@earth.ox.ac.uk
Elaine Sherrott	Administrative Assistant	10.33	72042	Elaine.Sherrott@earth.ox.ac.uk
Tony Fallows <i>7.30 am - 12.15 pm</i>	Receptionist	10.01	72000	reception@earth.ox.ac.uk
Francesca Oliver <i>12.00 - 4.30 pm</i>				
Yasuko Nakajima	Accounts Officer	10.28	72080	Yasuko.Nakajima@earth.ox.ac.uk
Elleri Pellagatti	Accounts Assistant	10.28	72042	Elleri.Pellagatti@earth.ox.ac.uk
	Administrator, Geodesy & Geophysics	40.18	82146	
Sara Tennakoon	Administrator, Geophysics & Geodesy	40.18	72057	Sara.Tennakoon@earth.ox.ac.uk
Hannah Jackson	Alumni Officer	10.30	72031	Hannah.Jackson@earth.oxa.c.uk
SAFETY AND SUPPORT STAFF				
Norman Charnley	Lab Manager for SEM and Stable Isotopes	30.26	72053	Norman.Charnley@earth.ox.ac.uk
Toby Christensen	Building and Facilities Manager	10.32	72054	Toby.Christensen@earth.ox.ac.uk
Linda Curson	Area Safety Officer		82132	Linda.Curson@earth.ox.ac.uk
Owen Green	Geological Facilities Manager	20.33	72071	Owen.Green@earth.ox.ac.uk
Phil Holdship	ICP Lab Manager	20.15	72037	Philip.Holdship@earth.ox.ac.uk
Jeremy Hyde	Geological Facilities Technician	0.12	72039	Jeremy.Hyde@earth.ox.ac.uk
Dave Pinchin	Workshop	0.17	72061	Dave.Pinchin@earth.ox.ac.uk

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Albert Hankins	Head of Workshop	0.43	72060	Albert.Hankins@earth.ox.ac.uk
Dave Sansom	Draughtsman	40.19	72024	Dave.Sansom@earth.ox.ac.uk
Steve Wyatt	Geochemistry Technician & Departmental Safety Officer	20.35	72005	Steve.Wyatt@earth.ox.ac.uk

Appendix 5 - Library Information

This guide is intended to give an overview of the Departmental Library and to introduce some of the other libraries that cover Earth Science subjects. The library system in Oxford, and the resources provided, can seem complex but the librarian is here to help, so please do not hesitate to ask.

Opening Hours

Members of the Department have 24-hour swipe access to the Library. The librarian's working hours the door are:

Monday:	8.30am-4.00pm
Tuesday:	9.30am-6.00pm
Wednesday:	8.30am-1.00pm
Thursday:	9.00am-5.00pm
Friday:	8.30am-1.00pm

Books

Finding books:

Books can be found by searching SOLO, which can be found at:

<http://solo.bodleian.ox.ac.uk>

This resource discovery tool gives details of the books held throughout nearly all of the libraries of the university (some colleges are not included e.g. University College).

It will indicate:

- the library (for example, books in this library will have the location EAR Main Libr or EAR Basement).
- the shelfmark, which indicates where the book can be found within each library
- the loan status, e.g. 'Confined' (when a book is for library use only) or 'Available' (when a book can be borrowed).

Borrowing books:

Books are borrowed using the Self-Issue Computer. Scan the barcode on your University Card and then scan the barcode INSIDE the book (NOT the publisher's barcode on the back of the book).

It is important to click the "Finish" button when scanning has been completed to prevent others taking books out in your name. Undergraduates are limited to 6 books on loan at any one time (Years 1 - 3) and 4th Years are allowed to have 12.

There are onscreen prompts and instruction notices beside the terminal. There is also a "problems" notebook beside the terminal for when the librarian is not in the library.

Books may be recalled after one week if requested by another reader. Otherwise, for undergraduates, they must be returned at the end of term. Staff and postgraduates have different loan periods.

All books need to be scanned out - even if they are being used in the Computing Lab or the Teaching Labs. If they are not scanned out it wastes time when people are looking for them, and the books are more likely to go missing.

Reservations:

Reservations may be placed via SOLO by clicking the "Hold Title" button on the left of the screen. Please note that you will also need to email the librarian. You are encouraged to use this system to request books that are on loan in order to keep the books circulating.

Renewals:

You may check your borrower record via SOLO to see:

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- what books you have on loan,
- when they are due back, and
- to renew them (where possible).

You will need to sign in to SOLO using your single sign-on credentials.

Please note that books cannot be renewed online after they are overdue. Please bring the books back so that they can be scanned back and then re-issued. It is possible for the librarian to renew them but it is better if the books are seen!

At present there is no system of fines and it is hoped that this situation can continue. This will depend, however, upon co-operation and consideration from everyone.

Returning books:

When **returning books** to the Library, please place them in the Returns box in the librarian's desk - books need to be scanned back into the library on the librarian's computer. Please do **not** put them back on the shelf or leave them on a table as the records will show them as still being on loan to you.

Please note that **whoever borrows a book from the Library remains responsible for it until it is returned**. In case of loss or damage you will be asked to pay for a replacement. It is not acceptable to plead that you passed it to a friend. If you do give the book to someone else, please let the librarian know - an email will do. This will save everyone a great deal of frustration as it will help to prevent books from going astray.

One week before the end of each term all outstanding loans must be returned to the Library. Books may then be borrowed for the vacation.

Confined Cupboard:

A selection of the books on the Undergraduate Reading List are kept locked in the "Confined Cupboard". These books must **NOT** be taken out of the Library.

Please make sure that Confined Cupboard books are signed out on the cards provided at the front of each book. These cards should then be left in the gap on the shelf. Confined books may be used when the out of the librarian's hours - by arrangement with the librarian - **but they need to be returned to the librarian's desk at the end of each day and not left on the tables around the library**. Please leave a note if you require them on the following day and then they can be left out on the librarian's desk for further use.

When the librarian is on leave, please contact Reception for a spare set of library keys. They can let you have access to the Confined Cupboard although this may be withdrawn if the books are not returned to the librarian's desk each night.

Material in the Basement:

When material from the basement is required there are green slips available to make requests, which are kept on the librarian's desk. Please place them in the box provided so that they can be fetched. All requests received by 11am will be fetched by 1pm on the same day, and on Mondays, Tuesdays and Thursdays there will be fetches before 5pm if slips are received before 3.30pm. Please let the librarian know how long the books will be required so that they can be returned to the basement when you have finished with them.



Journals

Finding journals:

Most journal titles can be found on SOLO or OxLIP+ [see below for further information].

There are over 100 journals held in hard copy by the library - those that are currently under subscription are in the library itself, and those that are not currently under subscription are kept in the basement. These can be fetched (or browsed by arrangement with the librarian). Please see the previous section for information on how to make requests from the basement.

The full-text of over 30,000 journals is available electronically via Oxford e-journals at:
http://oxford1.hosted.exlibrisgroup.com:8331/V/YURSLV874P7ANLF9VM1LB82A2L2L7CV9XH11HGVMKQ9KT17RU-25892?@pds_handle=GUEST

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SOLO can also be used, or the online journal indexes such as Georef, Web of Science or Scopus (available via OxLIP+) to find full-text articles or to check references and citations. (Google "OxLIP+" to find the page quickly). Please see the guides and leaflets on their use, which can be found in the library. OLIS lists the journal titles only, not the articles within them.

Borrowing journals:

NO periodicals may be borrowed. (See [Photocopying](#))

Maps:

The library holds a good collection of topographical and geological maps as follows:

- Ordnance Survey and foreign topographical maps are kept in the Confined Cupboard
- BGS folded maps are kept in the Confined Cupboard
- Flat BGS maps are in map cabinets in the library
- Foreign geological maps are kept in a variety of map cabinets and drawers - please ask the librarian for access.

The maps are not catalogued on SOLO but the librarian has a database of what is held. Undergraduates are not allowed to borrow them but may use them during the librarian's working hours. If they are required for longer, they may be used within the library by arrangement.

Tutorial Boxes:

By the door to the library, on bookcase L-20, there are box files containing copies of articles provided by some of the tutors - they include articles that are often quoted or that are difficult to obtain. They are arranged by year (and by tutor in a few cases). They are intended to make your life easier so **please be respectful to other members of your year and ensure that they are not removed from the library or left on desks but are returned promptly to the boxes (which should be kept, in order, on the shelves).**

Examination Papers:

Examples of past examination papers can be found in boxes on bookcase L-20 up to the years where the OXAM website took over. This can be found using OxLIP+ and past papers, as well as Examiners' reports for 2006 onwards are also available on Weblearn.

Mapping Reports:

These can be found in a collection of files on the Reference bookcase - L-19. They contain a collection of questionnaires about areas mapped in previous years by 2nd year undergraduates. These are arranged by country, and include maps as well as practical hints and tips that are invaluable for planning mapping projects. **These are the only copies and must not be taken out of the library.**

4th Year Projects:

Copies of the final projects submitted by 4th Year students are kept in the Confined Cupboard and should be consulted in the same way as the books held there.

Reprints:

The library has a collection of reprints of articles written by members of the Department. There is a card index listing the older ones, which is kept with the files in the basement. Recent articles will be kept on racks outside the Research Common Room.

Worldwide geology:

There is a good - if assorted - collection of material on the geology of countries throughout the world, such as Australia, Canada and various areas of Africa. This material has not yet been catalogued and is kept in the basement. Access is available upon request.

Photocopying / Scanning

There are no photocopying facilities in the Library although there is a scanner linked to one of the library computers. Undergraduates may only use the photocopier which is located behind the reception desk. It is only available during the hours when Reception is open. Copies are currently 5p per page and you are asked to fill in a record book by the copier.

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Printing

Printing in the department can only be done in the Undergraduate Computing Lab. It is advisable to have a memory stick with you in the library to enable you to download any papers that you find while working there so that you can print them later.

Inter-library Loans

These are arranged through the Radcliffe Science Library. Please ask the librarian for forms. There are also payment tokens available to postgraduates and academics.

The Bodleian Libraries

Finding journals:

Most journal titles can be found on SOLO or OxLIP+ [see below for further information].

There are over 100 journals held in hard copy by the library - those that are currently under subscription are in the library itself, and those that are not currently under subscription are kept in the basement. These can be fetched (or browsed by arrangement with the librarian). Please see the previous section for information on how to make requests from the basement.

The full-text of over 30,000 journals is available electronically via Oxford e-journals at:

http://oxford1.hosted.exlibrisgroup.com:8331/V/YURSLV874P7ANLF9VM1LB82A2L2L7CV9XH11HGVKMKQ9KT17RU-25892?&pds_handle=GUEST

SOLO can also be used, or the online journal indexes such as Georef, Web of Science or Scopus (available via OxLIP+) to find full-text articles or to check references and citations. (Google "OxLIP+" to find the page quickly). Please see the guides and leaflets on their use, which can be found in the library. OLIS lists the journal titles only, not the articles within them.

Borrowing journals:

NO periodicals may be borrowed. (See [Photocopying](#)).

Maps:

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Inter-library Loans

These are arranged through the Radcliffe Science Library. Please ask the librarian for forms. There are also payment tokens available to postgraduates and academics.

There are few rules for the library but they are intended for the benefit of everyone. Guidelines for using the library are as follows:

- The library is a quiet study area.
- Please do not bring any food or drink into the library at any time.
- Please do not leave any personal belongings on the desks. They will be collected on a regular basis so that all users have free access. There are slots by the Atlases/Outsize material if storage space is needed during lectures.
- Please use the self-issue machine to scan items you wish to borrow and return them promptly to the returns box in the librarian's desk, even when you are taking them to the Labs or the Common Room.
- If you think you are the last person to leave the library, please switch off the lights!

Above all else, please do not hesitate to ask for help if you require it.

Elizabeth Crowley
Departmental Librarian.

Telephone: (2)72050
Email: elizabeth.crowley@earth.ox.ac.uk

Appendix 6 - LECTURE FEEDBACK

Department of Earth Sciences Lecture Questionnaire

Please take a few minutes to respond to this questionnaire, indicating your response to each statement on a scale of **1 (strongly disagree)** to **5 (strongly agree)**.

	Lecturer					Lecturer					Lecturer				
The pace of the lectures was appropriate.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The lecturer was audible.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The lecturer gave structured presentations.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The lecturer made points clearly.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The lecturer used visual aids effectively.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The lecturer used handouts effectively.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The lecturer allowed opportunity for questions.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Handouts were clear and complemented the lectures.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The reading list was an appropriate length.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The reading list was pitched at an appropriate level.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The reading list complemented the lectures.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The practicals were integrated with the lectures.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Departmental library provision for this course was sufficient.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The course stimulated interest in the material.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Course material was pitched at an appropriate level.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The level of detail in the course was appropriate.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
The course adhered to the course outline.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
I felt adequately prepared for the course.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5

What additional preparation would you have liked?

Please add here any further comments you may have:

APPENDIX 7 - Academic Integrity: Plagiarism and Good Practice in Citation

Modified from: <http://www.admin.ox.ac.uk/epsc/plagiarism>

Plagiarism is the copying or paraphrasing of other people's work or ideas into your own work without full acknowledgement. All published and unpublished material, whether in manuscript, printed or electronic form, is covered under this definition. Collusion is another form of plagiarism involving the unauthorised collaboration of students (or others) in a piece of work.

Cases of suspected plagiarism in assessed work are investigated under the disciplinary regulations concerning conduct in examinations. Intentional or reckless plagiarism may incur severe penalties, including failure of your degree or expulsion from the university. The prohibition of plagiarism applies to all forms of set work, such as in tutorials or practicals. Plagiarism in tutorial work will be dealt with under your college's disciplinary code, with which you need to be familiar.

Plagiarism is a breach of academic integrity. It is a principle of intellectual honesty that all members of the academic community should acknowledge their debt to the originators of the ideas, words, and data which form the basis for their own work. Passing off another's work as your own is not only poor scholarship, but also means that you have failed to complete the learning process. Deliberate plagiarism is unethical and can have serious consequences for your future career; it also undermines the standards of your institution and of the degrees it issues.

Plagiarism can take the following forms:

- a) Verbatim quotation of other people's intellectual work without clear acknowledgement. Quotations must always be identified as such by the use of either quotation marks or indentation, with adequate citation. It must always be apparent to the reader which parts are your own independent work and where you have drawn on someone else's ideas and language.
- b) Paraphrasing the work of others by altering a few words and changing their order, or by closely following the structure of their argument, is plagiarism because you are deriving your words and ideas from their work without giving due acknowledgement. Even if you include a reference to the original author in your own text you are still creating a misleading impression that the paraphrased wording is entirely your own. It is better to write a brief summary of the author's overall argument in your own words than to paraphrase particular sections of his or her writing. This will ensure you have a genuine grasp of the argument and will avoid the difficulty of paraphrasing without plagiarising. You must also properly attribute all material you derive from lectures.
- c) Cutting and pasting from the Internet. Information derived from the Internet must be adequately referenced and included in the bibliography. It is important to evaluate carefully all material found on the Internet, as it is less likely to have been through the same process of scholarly peer review as published sources.
- d) Professional agencies. You must neither make use of professional agencies in the production of your work, nor submit material that has been written for you. This course of action would be one of the most serious breaches possible of the rules on plagiarism. It is also vital to your intellectual training and development that you should undertake the research process unaided.
- e) Collusion. This can involve unauthorised collaboration between students, failure to attribute assistance received, or failure to follow precisely regulations on group work projects. It is your responsibility to ensure that you are entirely clear about the extent of collaboration permitted, and which parts of the work must be your own.
- f) Inaccurate citation. It is important to cite correctly, according to the conventions of your discipline. Additionally, you should not include anything in a footnote or bibliography that you have not actually consulted. If you cannot gain access to a primary source you must make it clear in your citation that your knowledge of the work has been derived from a secondary text (e.g. Bradshaw, D. *Title of book*, discussed in Wilson, E., *Title of book* (London, 2004), p. 189).

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- g) Failure to acknowledge. You must clearly acknowledge all assistance that has contributed to the production of your work, such as advice from fellow students, laboratory technicians, and other external sources.
- h) Autoplagiarism. You must not submit work for assessment which you have already submitted (partially or in full) to fulfil the requirements of another degree course or examination.

The necessity to reference applies not only to text, but also to other media, such as computer code, illustrations, graphs, etc. It applies equally to published text drawn from books and journals, and to unpublished text, whether from lecture handouts, theses or other students' essays. You must also attribute text or other resources downloaded from web sites.

The University employs a series of sophisticated software applications to detect plagiarism in submitted examination work, both in terms of copying and collusion. It regularly monitors on-line essay banks, essay-writing services, and other potential sources of material. It reserves the right to check samples of submitted essays for *plagiarism*. Although the University strongly encourages the use of electronic resources by students in their academic work, any attempt to draw on third-party material without proper attribution may well attract severe disciplinary sanctions.

APPENDIX 8 - University Complaints Procedure

modified from: <http://www.admin.ox.ac.uk/proctors/info/pam/section13.shtml>



Introduction

If you have a complaint about something which is exclusively a college matter, this should be taken up with the relevant college officers. The Proctors do not have jurisdiction over internal college matters, including the setting of collections (internal college examinations) or college disciplinary procedures. Your college may have a published complaints procedure; help and advice can in any case be obtained from your JCR, MCR or college SU representatives. However, if your complaint is about a harassment-related problem you have the option of going instead to the University's Harassment Advisory Service for advice and to the Proctors to enquire about possible disciplinary action.

If you have a complaint about a University department or service (perhaps, the teaching or supervision which you are receiving; the academic provision or support facilities that you are using; other support facilities or services provided by the University), the first step is to take this up with the officer or body responsible for managing the academic programme or facility or service concerned. You may want to make a complaint yourself (preferably in writing), or get support from someone like your college tutor, subject tutor, supervisor, or a student Common Room or OUSU officer. Usually, the initial raising of a complaint is successful in resolving a problem. However, if you consider that a complaint about a University department or service has not been dealt with satisfactorily at local level, or there is a serious problem which you feel needs to be addressed elsewhere in the University system, then other procedures are available to you.



The Proctors and Assessor as 'Ombudsmen'

Because the Proctors (and to a lesser extent the Assessor) have a duty to ensure that the University's Statutes are upheld, they are able to act as independent 'ombudsmen' within the University system to investigate complaints and, where possible, provide redress. Student members of the University are therefore free to write to the Proctors or Assessor, or to ask for appointments with them, to raise any matters that do not fall exclusively within college jurisdiction. If a complaint is made formally, this will be considered by the Proctors and acted upon where necessary; the outcome will be communicated to the complainant. If the complaint relates to a matter that may amount to a disciplinary offence (e.g. harassment, infringement of freedom of speech), the Proctors will deal with this in accordance with their disciplinary procedures. The Proctors have codified procedures for the way in which complaints are dealt with; a copy may be obtained on request from the Clerk to the Proctors (tel. (2)70090) and can be seen on the University's web-site under Statutes and Regulations. The Proctors make an annual summary of complaints dealt with, for the information of the University Council and Congregation.

In the specific area of examinations the Proctors have well-established mechanisms for considering complaints about the conduct of examinations. They cannot, however, challenge the academic judgement of examiners or academic bodies. More detailed information about these complaints procedures is available from the Proctors' Office and can be found on the [University's](http://www.admin.ox.ac.uk/statutes/regulations/) web-site (go to <http://www.admin.ox.ac.uk/statutes/regulations/> and look under Complaints). By convention, the Junior Proctor takes primary responsibility for matters relating to taught-course examinations, while the Senior Proctor deals with research-degree examinations. In both areas, if the Proctors are concerned that there may have been a flaw in the conduct of an examination, they will typically ask the examiners or others involved to review what happened and make a report to them. If the Proctors are satisfied, they will inform the student (either direct, or via his/her college) why the complaint is not upheld. If they are not satisfied, the Proctors will continue to investigate until they are in a position either to dismiss the complaint or else to uphold it and provide suitable redress (e.g. revision of results, re-examination). It is open to dissatisfied complainants to bring forward fresh evidence and ask for a decision to be re-considered.

There is a right of appeal to the Office of the Independent Adjudicator.

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Students are free to contact the Clerk to the Proctors to discuss (in confidence and without committing themselves to any action) a potential complaint and the procedures that will be followed if the complaint is formally submitted (tel. (2)80190).

Academic Integrity in Research

The University expects all staff and student members of the University, and non-members who are conducting research on University premises or using University facilities, to observe the highest standards in the conduct of their research. It has established a Code of Practice and Procedure for Academic Integrity in Research. Under this, fabrication, falsification, plagiarism or deception in proposing, carrying out or reporting the results of research would be regarded as misconduct, as would dangerous or negligent deviations from accepted practice in carrying out research. Research misconduct also includes failure to follow an agreed protocol if this failure results in unreasonable risk or harm to humans, other vertebrates or the environment. Similarly, collusion in, concealment of, and conspiracy to attempt misconduct would be regarded as a breach of the code.

A copy of the Code of Practice is available from the Clerk to the Proctors (tel. (2)80190), together with details of the procedures for dealing with complaints about research misconduct. Information can also be found on <http://www.admin.ox.ac.uk/ps/>.

Office of the Independent Adjudicator

The OIA provides an independent scheme for the review of student complaints. Where the OIA rules in favour of a student, it may recommend that the University or college should do something (e.g. look again at a complaint, or pay compensation) or refrain from doing something.

In order to activate the OIA procedures, you must be a current or former student of the University or one of the Colleges *and must have first exhausted all the available internal procedures*. To confirm that your case has been dealt with internally, you need to obtain a Completion of Procedures Letter from the person who has informed you about the outcome of your case. You have a maximum of *three months* from the date of the Completion of Procedures Letter to apply to OIA.

The Independent Adjudicator can deal with complaints about programmes of study or research, services provided to you as a student by the University and/or your college, a final decision by the University or your college about a disciplinary matter or a complaint. The OIA cannot, however, deal with complaints about matters of academic judgement, matters that are the subject of legal proceedings, or matters relating to student employment.

Information can be found at <http://www.oiahe.org.uk/> or by e-mailing enquiries@oiahe.org.uk.

APPENDIX 9 - The links between research and teaching

The Department of Earth Sciences has an international reputation for its research profile, and there many benefits to the processes of teaching and learning that follow from this high level of research activity. All of the tutors and lecturers with whom you will interact over the duration of your course are employed not only to teach you, but are also actively engaged in research. Many of the individual academic staff in the department are known internationally as leaders in their own specialist fields.

The impact that this research has on teaching takes many forms - ranging from the introduction of new ideas into lectures, practical and field classes and tutorials, to the opportunities that you will have to engage in research in the fourth year of the course. In turn, teaching also has an impact on our research. Nothing exposes the weakness of an idea or an argument quite as much as when have to explain it to an audience, as you will find out in tutorials and seminars throughout the course.

The article below, which was written by Philip England, explains the way that field work, in particular, helps to build the relationships between students and lecturers in the department.

Earth Science students experience particularly informal social and working relationships with academics, rooted in the nature of field work that gradually includes them into the scholarly community.

The core aspect of Oxford undergraduate teaching is close contact between the student and people engaged in research at the highest international level, and that contact is often identified with the traditional one-on-one or two-on-one tutorial. The purpose of this article is to describe the interactions within a small science department, and to suggest that there are additional routes towards the same quality of experience.

Earth Science is, to first order, not taught in schools, and most applicants to our undergraduate course have been attracted to the subject through their individual curiosity about some aspect of geology - earthquakes, volcanoes, evolution of life, and the origin of the solar system are common examples. The goal of our course is to give students the analytical and observational apparatus to convert that curiosity into an effective tool for investigation of the (always inextricably interlinked) physical, chemical, and biological processes that govern the evolution and present state of the planet upon which we live. When we discuss how we try to achieve this goal we rarely discuss teaching strategies or learning outcomes, because we regard the undergraduate experience as more akin to an apprenticeship than to four years of formal teaching.

Fieldwork is a central aspect of Geology and, almost irresistibly, it imposes a flavour upon our teaching. In a tutorial, even with the most able students, the tutor always has some element of control: topics can be specified, limits of discussion can be defined and, if all else fails, one can escape at the end of the hour. A day in the field typically involves more than 12 hours of close-contact teaching, in which the agenda is set by the observations that the students make, and the questions that they pose. Frequently, those questions have no known answer. Even if one wished to claim Olympian omniscience, that bubble would be pricked by the unexpected or inexplicable observation; there is no place to hide. The nature of field teaching forces the teacher to treat the experience as a collaborative enterprise in interpretation of the aftermath of Nature's experiments, rather than as the transfer of received wisdom from the old to the young.

It is also the case that ties between students and their college tutors remain strong. Earth Sciences is a very diverse discipline, and undergraduates reflect the interests of their tutors to a greater degree than is explicable by pure chance. However, because the undergraduates know the personalities and interests of the academic staff they can make informed choices about the route through their education and by the time they embark on their 4th-year research project, they are usually grappling with a problem in which they have a close personal interest. We believe that an environment that minimizes the barriers between staff and students is essential if our students are to effect the transition from the memory-driven toils of A-level to free-standing members of the research community.