

Handbook for Students and Faculty

MIT-WHOI Joint Program in Marine Geology & Geophysics

Prepared by the Joint Committee for Marine Geology and Geophysics
(July 1997; modified November 2002; July 2004; April 2006; September 2011; August 2012;
December 2013; January 2014; March 2014; July 2014; March 2015; February 2016; March
2016; September 2016; October 2016)

Introduction

The MIT/WHOI Joint Program in Marine Geology and Geophysics offers graduate students a unique opportunity for training and research in fields including geophysics, paleoceanography, petrology and geochemistry, and coastal processes. This Handbook is for students and faculty in Marine Geology and Geophysics; it describes the framework within which a graduate student progresses toward the doctoral degree. It is intended to provide continuity and direction for graduate studies while allowing considerable latitude for individual courses of study and research opportunities. It also provides guidelines for the conduct of examinations, etc. in order ensure uniformity of standards. The 2004 statement on interdisciplinary research (<http://web.mit.edu/mit-who/ww/policies/interdisciplinary.html>) provides additional guidelines for students whose research interests significantly overlap two or more Joint Committee focal areas.

Background

In 1968, the Woods Hole Oceanographic Institution (WHOI) and the Massachusetts Institute of Technology (MIT) entered into an agreement to conduct a cooperative academic program leading to graduate degrees in oceanography and ocean engineering. The joint degrees awarded are single documents issued by both institutions. Jointly constituted committees make all decisions of substance in the program from admissions to degree granting. The Joint Committee for Marine Geology and Geophysics (JCMG&G) oversees the Joint Program for Marine Geology and Geophysics (MG&G). It is composed of staff members of the Department of Geology and Geophysics at WHOI and of the Department of Earth, Atmospheric and Planetary Sciences at MIT. JCMG&G acts on behalf of the entire scientific and academic staff of the two departments and oversees the overall academic progress of each student in the program.

Requirements for the Ph.D. Degree

There are certain minimum requirements for the doctoral degree in MG&G which a student is expected to fulfill. These requirements are the following:

1. Take and satisfactorily complete a program of academic subjects that meet the course requirements. These are selected by the student and his/her Academic Advisors, and are approved by JCMG&G.
2. Select, conduct research on, and prepare scientific papers on two General Topics.

3. Pass a General Examination based on general knowledge, course preparation, and the presentation and content of the two research papers.
4. Present a thesis proposal based on proposed thesis research.
5. Successfully prepare and defend a doctoral dissertation based on original and independent research.

During a graduate student's career, the student is expected to keep JCMG&G apprised of his/ her progress, including annual submission of the MG&G Student's Progress Report (Appendix I), and in-person meetings with JCMG&G as requested by the student or JCMG&G. In addition, the student is expected to devote full time to work as a student. Students will most likely be supported by a Graduate Research Assistantship through a grant or contract, and they are expected to work on the grant/contract in question at least 20 hours per week total. Specifics of how the 20-hour obligation is to be satisfied (e.g. research assistance, joint research, course-related work, etc.) is determined by mutual agreement between the student and Advisor(s).

Academic Advising and Oversight

1. Academic Advisors

Academic Advisors have broad responsibilities for a student's overall academic and research progress. It is essential that a student and his/her Advisors set up a schedule for regular interaction. Pre-General Examination students will have two Academic Advisors, one at MIT and one at WHOI. After a student passes the General Examination, he/she will have a Thesis Advisor(s). The primary responsibility of the Advisors is to guide the student's academic program, help define, conduct, and obtain support for, research for the General Examination papers and thesis proposal, and act as the student's advocate before JCMG&G. An Advisor's communication with JCMG&G is also essential. Progress of students should be reported as requested by JCMG&G, including annual submission of the MG&G Advisor's Report on Student Progress (Appendix II). Results of meetings, examinations, etc. where decisions are made affecting the student's graduate career should be documented in writing and sent to JCMG&G and both the MIT and WHOI Joint Program Education Offices.

2. Education Coordinator

The Education Coordinator is a member of the Department of Geology and Geophysics at WHOI. The role of the Education Coordinator is to strengthen the quality and continuity of the education program within MG&G by serving as a source of information and advice to both students and Advisors. The Education Coordinator is available to talk with students and Advisors about any aspect of the education program or the graduate school experience. The Education Coordinator has many specific duties including (1) providing information to students on curriculum matters, WHOI and MIT policies and regulations, sources of research funding; and (2) acting in cooperation with Advisors, JCMG&G, and the Education Office to help resolve academic or personal problems of students.

The current Education Coordinator is listed here:

<http://mit.who.edu/education-coordinator>

3. Joint Committee for Marine Geology and Geophysics

JCMG&G is responsible for oversight of all aspects of the graduate program in MG&G - admissions, review of students' progress, committee membership approval, acceptance of final drafts of dissertations, etc.

Current JCMG&G members can be found here:

<http://mit.who.edu/page.do?pid=34583>

In particular, JCMG&G is responsible for the following:

1. Setting up a curriculum that meets the course requirements for each student when they enter the Joint Program.
2. Appointing each student's Academic Advisors.
3. Reviewing the progress of each student in the Joint Program twice yearly.
4. Approving the topics of the two research papers to be presented by the student in the General Examination.
5. Approving proposed members of the student's General Examination Committee and Thesis Proposal Committee.
6. Deciding, on the basis of the student's academic standing, course preparation, Application for Candidacy, and performance on the General Examination and Thesis Proposal Presentation, whether the student will be admitted to candidacy for the doctoral degree.
7. Approving the student's proposed Thesis Committee and Thesis Defense Chairs.
8. Recommending to the Deans of the Joint Program, on the basis of the Thesis Defense, whether the doctoral degree should be conferred on the student.
9. Reviewing petitions and otherwise deciding, on the basis of a student's demonstrated progress (or lack thereof), about the student's continued enrollment and financial support in the Joint Program.

Progressing towards the Doctoral Degree

Normal residence time in the Joint Program is 5 years. The following table shows the schedule that students are expected to meet to fulfill their requirements in the MG&G program. This schedule will take effect for the students entering the Joint Program in the year 2000. Each of these steps is discussed in the following sections.

Table 1: Schedule for Students in MG&G

| Year | Fall | Spring | Summer |
|-------------|---|------------------|---------------|
| 1 | Classes/research | Classes/research | Research |
| 2 | Classes/research | Classes/research | Research |
| 3 | General Examination; Thesis Proposal Presentation | Research | Research |
| 4 | Research | Research | Research |
| 5 | Research | Thesis Defense | |

Year 1:

- At start of year, meet with Academic Advisors to set up a curriculum for the first two years; meet with JCMG&G for approval of that curriculum.

- Identify two research topics as required for the General Examination.

Year 2:

- Meet with JCMG&G at start of year to discuss progress in the program, and any changes to the planned courses.
- Submit topics and abstracts of proposed research papers to JCMG&G by the end of the fall semester; submitting the topics earlier than this is encouraged.
- Meet with Advisors of the two General topics in the Fall and send a summary of the meeting to JCMG&G.
- Submit proposed membership of the General Examination Committee to JCMG&G for approval at least 2 months prior to the exam.

Year 3:

- Submit Application for Admission to Candidacy 3 weeks before the General Examination.
- Submit research papers to the General Examination Committee 3 weeks before the exam.
- Complete the General Examination at the appointed time in the Fall Semester.
- Submit proposed membership of the Thesis Proposal Committee to JCMG&G for approval at least 2 months prior to the Thesis Proposal Presentation.
- Schedule and complete the Thesis Proposal Presentation within 3 months of the General Examination.
- Submit proposed membership of the Thesis Committee to JCMG&G for approval within 2 months of finishing the Thesis Proposal Presentation.

Years 4 and 5:

- Conduct proposed thesis research.
- Meet with Thesis Committee in the Fall of each year, and send a summary of the meeting to the JCMG&G chair, with copies to the Education Offices and your advisor(s).
- Submit the name of Thesis Defense Chair to JCMG&G for approval two (2) months before the scheduled defense.
- Submit a complete draft of the thesis to all committee members, including the Chair, and receive their comments and their approval for submittal of the defendable draft and scheduling the defense, *before* the thesis is scheduled and the defendable draft submitted.
 - Submit copies of the defendable draft to the Thesis Committee and Thesis Committee chair, and to the Academic Programs Office at WHOI and the EAPS departmental office at MIT, three (3) weeks before the defense. The student, in consultation with the Advisor and committee, also needs to schedule the defense with the Academic Programs Office at WHOI and the Joint Program Office at MIT at least three (3) weeks prior to the defense. It is the Advisor's responsibility to insure that the defense is arranged and advertised.
 - Complete the Thesis Defense.

Curriculum - Years 1 and 2

During the summer before the student's first academic year, JCMG&G will recommend two Academic Advisors (one each at MIT and WHOI) for each student. Before registration for the first semester of regular academic residence, the student will meet with his/her Academic Advisors and formulate a program of courses appropriate for the student's background and research interests. (Sample tracks for different subdisciplines of JCMGG are provided at the end of this handbook). The student meets with JCMG&G at the beginning of the Fall Semester.

JCMG&G will confirm the student's two Academic Advisors, and either approve, or suggest modifications to, the proposed program of subjects. Class selection will be reviewed again at the student's meeting with JCMG&G at the beginning of the second academic year.

Students entering the program in Fall 2015 or later have the following requirements:

(1) 12.710 Geological Oceanography. Presents background material that all graduate students are expected to know in the disciplines of solid-earth geophysics, geochemistry, sedimentology and stratigraphy, coastal processes, and climate. Barring conflicts, it is suggested that the student take this class during their first Fall semester.

(2) 12.754 Presenting Scientific Research. Students are required to take the Seminar once during either Year 1 or Year 2, and are encouraged to take it more than once, as their schedules permit.

(3) A data analysis class. Examples include:

1.715: Environmental Data Analysis

12.444: Matlab, Statistics, Regression, Signal Processing

12.714: Computational Data Analysis

12.747: Modeling, Data Analysis and Numerical Techniques for Geochemistry

12.864: Inference from Data and Models

Other classes, selected in consultation with advisor(s), may be approved by JCMG&G.

These are by no means the only classes the student is expected to take. The recommended course load is 2-3 per semester in Years 1 and 2, although this is flexible depending on the needs of the student. Example course tracks are given on pages 27-32 of this handbook.

For students entering the program Fall 2013 - Spring 2015 there is a breadth requirement in place of (1) Geological Oceanography:

A series of elective subjects selected in consultation with the student's Academic Advisors and JCMGG. To meet the breadth requirements, these classes must include *one* course from at least *three* of the following four categories:

Geology/Sedimentology

Geophysics/Tectonics

Climate/Paleoceanography

Petrology/Geochemistry

Classes to meet these breadth requirements may be taken in other departments.

Students may request to follow the new requirements.

General Examination Research - Years 1 and 2

1. Guidelines for Selecting General Examination Research Topics

For the General Examination in MG&G, students are required to present the results of two independent research projects in both written and oral form. The ideal pair of General Examination topics would satisfy the following criteria:

1. Represent two different fields in Marine Geology & Geophysics

The various fields represented in Marine Geology & Geophysics include seismology, geomagnetism, tectonics, volcanology, paleoceanography, petrology, geochemistry, and coastal processes. JCMG&G encourages students to select General Examination topics from two of these fields, but recognizes that some students may identify different research topics that represent two subdisciplines within a field (for example; in geophysics, topics in seismology, gravity, geomagnetism, tectonics, etc.; in paleoceanography, topics in stable isotopes, geochemical modeling, micropaleontology, etc.; in petrology and geochemistry, topics in radiogenic isotopes, trace elements, mineral chemistry, etc.). The choice of topics should be designed to ensure breadth in scientific background, and to allow students the opportunity to explore different types of research projects before focusing on a thesis project. It is also acceptable to choose a General Examination topic that is within a different field of Oceanography (e.g., Physical Oceanography or Marine Chemistry).

2. Involve different approaches to the solution of problems

Almost as important as demonstrating the necessary breadth in physics, chemistry, and geology to solve problems in different fields is displaying the ability to use different methodologies. Possible approaches to solving scientific problems include the development of theory, collection and analysis of field data, and experimental studies in the laboratory. Some studies use a combination of two or more of these approaches, but typically the emphasis of a study will be on using one of these techniques.

3. Be supervised by two different Advisors

Scientists have different approaches to their science. In addition, scientists use different techniques in writing up the results of their research. It is therefore beneficial for a student to have substantive interaction with two different Advisors.

4. Be conducted at the two different Institutions

The MIT and WHOI institutions also are different. WHOI has more depth than MIT in most fields of MG&G, while MIT has more breadth and depth than WHOI in non-marine aspects of G&G. Students in the Joint Program have the unique opportunity to conduct research at both institutions, and hence it is advantageous for a student to work with Advisors at the two different institutions.

JCMG&G recognizes that all students will not be able to do two research projects that meet this ideal set of criteria, and that there is a need for flexibility based on the circumstances of each individual student. In preparing a memo for JCMG&G's approval of the proposed General Examination topics, a student should first describe the scientific questions to be addressed, and then discuss the extent to which the two projects are different as judged by the criteria listed above. JCMG&G requires that students obtain approval of the two research projects **by the beginning of their 3rd semester.**

2. General Examination Papers Content

Each of the two research papers that constitute part of the General Examination should not exceed 20 pages of double-spaced 12-point font text, including text in any supplementary sections. A maximum of 10 figures is permitted in each paper. Please be certain to stay within these length requirements.

Given the short (5th semester) General Examination deadline discussed below, it is not expected that the research papers will be manuscripts ready for submission to a journal for publication; rather, they are to be research papers of high quality that show innovative thinking and an ability to conduct research and present the results coherently.

Note for Those Students Entering the Joint Program with a M.S. degree

Students entering the Joint Program with a M.S. degree in a related field may be able to:

- submit their M.S. thesis as one of their Generals topics
- if appropriate, move the Generals Examination up to the start of their 2nd year

1. *Submitting research done for a M.S. thesis as a General Examination research topic*

It is the responsibility of the student's Academic Advisors to review the M.S. thesis and make a recommendation to JCMGG concerning its disposition. Possible recommendations include:

(1) the work is sufficient and meets the standards of a General Examination paper in MG&G

If approved by JCMGG, the student will work with his/her Academic Advisors to ensure that the General Examination Papers content and format guidelines are met on schedule for the General Examination. It should be noted that JCMGG will judge the second proposed General Examination research topic on the basis of the criterion outlined in the section General Examination Research – Years 1 and 2. Under these circumstances, it should be possible for the student to accelerate the timing of the general examination (see below).

(2) additional work is required to make it a suitable General Examination research topic. The student will follow the guidelines in section General Examinations Research – Years 1 and 2, and submit an abstract for the proposed additional work.

(3) the topic or scope of work is insufficient or inappropriate for a Joint Program General Examination paper

The student will be expected to conduct two independent research projects.

2. *Moving the Generals Examination up to the start of the 2nd year*

In some cases where a student has already had considerable course work and is completing only one new research project for his/her General Examination, he/she may wish to complete the General Examination in the 2nd year rather than at the beginning of the 3rd year. Students should submit a request for approval to JCMGG that includes a letter of support from his/her Academic Advisors.

The General Examination - Fall Semester of Year 3

1. General Examination Committee and the Schedule of the Examination

All students in their fifth semester will be expected to take their General Examination during a two week period at the end of September. In truly exceptional cases (e.g. when the Advisor is at sea), the Examination date can be extended for up to one month.

A student's General Examination Committee will consist of the MIT and WHOI academic advisors, General Examination Projects Advisors (who may or may not be the same as the academic advisors), and one or two specialists in appropriate fields selected by the student and the Advisors. To provide for uniformity of standards, a member of JCMG&G who does not advise the student will also be part of the Exam Committee. The Chair of the General Examination will be chosen by the student, but must be one of the non-advisor members of the Committee. At least **two months** prior to the General Examination, the student will submit a memo for JCMG&G's approval of the Committee and Chair.

2. Preparations for the General Examination

Six weeks before the General Examination, the student will meet with his/her General Project Advisors and the Chair of the Examination to discuss the expectations for the Examination.

At least **three weeks** before the General Examination, the student, in consultation with the Advisor, the committee, and the JCMG&G committee member, will schedule the date, time, and meeting facility for the examination, and transmit this information to the JCMG&G Chair, and to the Joint Program Education offices.

3. Application for Admission to Candidacy (see Appendix III)

At least **three weeks** prior to the General Examination, a student must submit an Application for Admission to Candidacy. This Application includes the student's curriculum vitae, a summary of subjects taken and grades obtained (past and present), research interests/accomplishments, a list of the two research papers that will be defended in the General Examination, the topic of the proposed thesis research, and the name(s) of the proposed Thesis Advisor(s). The Application should bear the approval (via signature) of the student's Academic Advisors. A more complete summary of material to be included in the Application is listed in Appendix III. The Application should be submitted simultaneously to the Education Offices at WHOI and MIT, and to the members of the student's General Examination Committee.

At the same time (i.e., at least **three weeks** prior to the exam), the student must submit complete copies of the two research papers to the members of the General Examination Committee and to both Joint Program Education Offices. With the submission, the student will confirm that the papers meet the maximum length requirements.

4. Conduct of the General Examination and Responsibilities of the Chair

Before the start of the Examination, there will be a 5-10 minute meeting of the Committee members, during which the Chair will discuss the format of the Examination and the background of the student. The General Examination is typically three hours long. It will consist of two twenty minute presentations. Each presentation will describe one of the General Projects, and each will be followed by questions from the Committee. In addition, a period of questioning on background knowledge will be conducted based on the course work and research the student has completed to date.

Interested MIT faculty and WHOI Education Assembly members who have read the student's two research papers may attend a student's General Examination with prior approval of the Committee Chair in consultation with the student. These individuals may observe the

Examination and ask questions about the Generals Projects at the invitation of the Committee Chair, but have no voting rights at the time that the General Examination Committee finalizes its decision.

It is the responsibility of the Chair of the Examination to ensure that the student is examined thoroughly, yet fairly. The Chair must ensure that the time allocation allows sufficient time for questions on both research papers and on background knowledge. It is left to the discretion of the Chair to decide when to cut off questions from a particular examiner or the entire Committee.

Following the General Examination, the student will leave the room and the Committee will deliberate on whether the student has demonstrated the background knowledge and ability to conduct doctoral-level research. The following procedure will be used:

- (i) Immediately after the student leaves the room and before discussion begins, each Committee member will write down a grade on each of the student's research papers and background knowledge and give this to the Chair.
- (ii) The Chair will make these grades known to the entire Committee, and will lead a discussion of the results. Following this discussion, each Committee member will write down a final grade on each of the two papers and background knowledge.
- (iii) The Chair will collect these grades and recapitulate a summary opinion. Possible recommendations of the General Examination Committee include the following: (1) the student proceeds to the Thesis Proposal Presentation; (2) the student must repeat part of the Examination; (3) the student must complete an M.S. degree and leave the Joint Program; or (4) the student must leave the Joint Program without a degree.
- (iv) The examination results and summary opinion will be written down by the Chair using the General Examination form (Appendix IV). The Chair will obtain the signatures of all Committee members on this completed summary and will transmit it, together with any specific written comments of individual Committee members to JCMG&G with copies to the Education Offices at WHOI and MIT. The Chair will also transmit a separate written account of the examination results to the student with a copy to JCMG&G, the student's Advisors, and the Joint Program Education Offices.

The Thesis Proposal Presentation - Fall of Year 3

1. Thesis Proposal Committee Approval and Scheduling of the Presentation

The presentation of the Thesis Proposal should occur **within three months** of the Generals Examination. The Thesis Proposal Committee will consist of 5-6 members, and will include the following: the thesis Advisor(s), at least one member each from MIT and WHOI, and three experts in the proposed field of research or closely allied fields of research. Potential members of the Thesis Committee will generally be members of the student's Thesis Proposal Committee. Committee members from outside institutions are acceptable. The Chair will be an individual familiar with the student's proposed research, but will be someone other than the student's Academic Advisors or proposed Thesis Advisor.

At least **one month** before the Thesis Proposal Presentation, the student should submit the proposed membership and Chair of his/her Thesis Proposal Committee to JCMG&G for approval.

At least **three weeks** before the Thesis Proposal Presentation, the student, in consultation with the Advisor and committee, should schedule the date, time, and meeting facility for the Presentation and transmit this information to the JCMG&G Chair, and to the Joint Program Education offices.

2. Conduct of the Thesis Proposal Presentation

The Thesis Proposal Presentation provides the opportunity for a student to prepare and present the research topic which he/she proposes for thesis research. The format is one of a presentation followed by discussion and suggestions for the student -- it is not an examination.

At least **three weeks** prior to the Thesis Proposal Presentation, a Thesis Proposal no longer than 10 pages of 12-point font, double-spaced text, and containing no more than 10 figures, will be submitted to the Thesis Proposal Committee and to the Joint Program Education Offices. The Thesis Proposal should outline succinctly the following: (1) the proposed research topic, (2) background information, (3) the merit and importance of the proposed research (how it will lead to new discoveries or fundamental advances in marine geology and/or geophysics), (4) the proposed plan for conduct of the research, and (5) a general statement about the anticipated results. The proposal should be accompanied by a statement outlining the source of funding for the project.

A Thesis Proposal presentation typically lasts about 2 hours, beginning with a 20-30 minute presentation of the proposed research by the student, followed by questions and discussion among the student and the Committee. Interested MIT faculty and WHOI Education Assembly members who have read the Thesis Proposal may attend a student's Thesis Proposal Presentation and, at the invitation of the Committee Chair, ask questions and participate in the discussion. Issues that should be included in the discussion include the scientific merit, originality, and viability of the proposed research, the adequacy of the student's background for the proposed research, and the likelihood that the necessary resources (financial, logistical, intellectual) will be available for the research.

After completion of the discussions, the student will leave the room so that the Committee can synthesize and summarize their conclusions and recommendations for subsequent presentation to the student. The Chair will write a letter to JCMG&G, with copies to the Education Offices at WHOI and MIT, that summarizes the results of the Presentation, and recommends whether the Thesis Proposal is acceptable or must be modified, and whether the student's background is suitable for the proposed work. The Committee Chair will also transmit a written account of the results to the student with a copy to JCMG&G, the student's Advisors, and the Education Offices. If the Thesis Proposal needs modification, the Committee is expected to work with the student to revise his/her plan, and the letter should include a timetable for modification. An acceptable plan must be developed before the beginning of the 6th semester. Once the Committee agrees that the revised Thesis Proposal is acceptable, then the Chair should write a letter to JCMG&G, with copies of the Education Offices at WHOI and MIT, informing

them of the Committee's approval. If the student's background is considered inadequate, the means for overcoming this should be specified in the letter.

3. Admission to Candidacy

Following a student's completion of the Thesis Proposal Presentation, JCMG&G will review the student's course preparation (including required core curriculum), Application for Admission to Candidacy, and results of the General Examination and Thesis Proposal Presentation. If each of these elements for admission to candidacy has been completed satisfactorily, JCMG&G will admit the student to candidacy for the doctoral degree and will so inform the student, Advisor(s), and the Directors of the Joint Program in writing. If a student fails to gain admittance to candidacy, JCMG&G will transmit a written statement to the student, Advisor(s), and the Directors of the Joint Program recommending that the student complete an M.S. degree or that his/her graduate student status be terminated.

Thesis Research - Years 3 and 4

1. Thesis Committee Membership

The Thesis Committee should be formed within 2 months following the Thesis Proposal Presentation, and the proposed membership of the Committee should be submitted to JCMG&G for approval. The Committee consists of 4 to 6 members, including at least one staff/faculty member each from MIT and WHOI. Thesis Committee members from outside institutions are acceptable when circumstances so dictate. Changes in the membership of the Thesis Committee deemed necessary at a later date by the Thesis Advisor(s) in consultation with the student must be submitted in writing to JCMG&G for approval.

A student's Thesis Committee acts as an advisory body during the course of the student's dissertation research, monitors the student's research for satisfactory progress, and examines the student on that research at the time of his/her Thesis Defense. It is the responsibility of the Thesis Committee to meet regularly enough to assess the student's progress, and provide advice to guide the student through the research project. The Thesis Committee is expected to meet regularly, and at least in the Fall of every year when it should prepare a summary of the student's progress to be sent to JCMG&G for its January meeting. The student should take responsibility for setting up meetings with his/her Thesis Committee.

2. Thesis Content

In general a thesis consists of five parts:

1. Abstract
2. Historical review and background of the problem
3. Chapters that develop the original contribution toward the solution of the problem
4. Final summary of the student's work and its significance
5. Bibliography.

The student is encouraged to incorporate, as part of item 3, published manuscripts or manuscripts that either have been prepared or submitted for publication, provided that they are partly or entirely their original contribution. If the paper has been published and copyrighted, a waiver of the copyright must be submitted with the thesis.

If multiply authored paper(s) are included in a thesis, the student must obtain statements from all co-authors detailing their specific contribution to the paper(s) in question and submit these to JCMG&G. No doctoral thesis that contains such multiple-authored papers will be accepted for final approval without these statements or without the explicit written permission of JCMG&G.

Detailed information about the requirements for preparation and submission of the thesis are given in two booklets: “Specifications for Thesis Preparation” which describes the MIT requirements, and “WHOI Specifications for Thesis Preparation” which describes the Joint Program requirements. Both booklets are available at the Joint Program Education Offices at WHOI and MIT.

The Thesis Defense - Year 5

At least two months in advance of a student’s Thesis Defense, the Thesis Advisor(s), after consultation with the student, should recommend to JCMG&G, the Chair of the Thesis Defense. The Chair of the Thesis Defense is an individual who is not a member of the Thesis Committee, but who is cognizant of the student’s research field. The Chair reads the thesis and acts as a full committee participant in the Thesis Defense.

Prior to the student’s submission of the defendable draft and the advisor’s scheduling of the defense, all committee members, including the Chair, must receive a complete draft of the thesis. The committee must be given the opportunity to provide comments and suggestions to the student, which the student can then incorporate into their defendable draft. Before the submittal and scheduling may take place, the student and advisor must certify on the Doctoral Dissertation Defense Notice form that each committee member has approved submittal of the defendable draft and scheduling of the defense.

At least three weeks prior to a student’s Thesis Defense, the student, in consultation with the Advisor and the Thesis Committee, will schedule the defense and inform the Academic Programs Office at WHOI and the Joint Program Office at MIT of the date, time and meeting facility for the defense, the thesis title, and the composition of the Thesis Committee and the Chair of the Defense. The Academic Programs Office and Joint Program Office will then advertise the defense.

At least three weeks prior to the Defense, the student must submit a defendable draft of the final thesis, which will then be available to interested members of the faculty at MIT and WHOI. The student should submit copies of his/her defendable draft to the Academic Programs Office at WHOI and the EAPS departmental office at MIT, and to each member of the Thesis Committee. The Joint Program Offices will invite the staff and faculty of the two institutions to the Thesis Defense via public notice.

In some rare instances, it may not be possible for all members of a student’s Thesis Committee to be present for the Thesis Defense. These individuals should be provided with a copy of the final thesis at the same time as other committee members (i.e. at least three weeks before the Thesis Defense), and they should submit written comments on the thesis for consideration by the full committee at the time of the Thesis Defense.

The Thesis Defense consists of two parts: (1) a public presentation (normally about 45-50 minutes long) of the results of part or all of the thesis research, with a brief public question and answer period (10-15 minutes long) presided over by the Thesis Defense Chair, and (2) a private defense of the research results, also presided over by the Thesis Defense Chair (normally 1-2 hours long). Interested MIT faculty and WHOI Education Assembly members who have read the thesis may attend the private defense and ask questions of the student and participate in discussions following the examination. However, these individuals have no voting rights at the time that the Thesis Committee finalizes its decision.

Following the period of questioning in the private defense, the student will retire from the room and the Thesis Committee will consider its recommendation. Each committee member will first write down his or her recommendation (pass, conditional pass, fail) and give it to the Chair. The Chair will record these results, make them known to the full Committee, and lead a discussion on Committee recommendations. Following this discussion, each Committee member will give the Chair his/her final vote. The Chair will record the final vote, together with comments, qualifications, and Committee recommendations, on the form "Thesis Defense Form" (Appendix V), and obtain the signatures of all Committee members on the form. Successful defense of the thesis is signified by unanimous approval of the Thesis Committee.

Following a successful defense, the Chair of the Thesis Defense will transmit the Committee's approval in writing to JCMG&G and to the Education Offices at WHOI and MIT, requesting that the student be recommended to the Faculty and Staff of the Joint Program for conferral of the doctoral degree. The Chair of the Defense should also transmit an account of this recommendation to the student.

If the student does not defend his/her thesis successfully, the Thesis Defense Chair will similarly transmit this result in writing. If the Thesis Defense results in a conditional pass, the student will be required to correct deficiencies in his/her dissertation research and/or thesis and then obtain final approval from the Thesis Committee. The method and schedule whereby the deficiencies are to be corrected will be specified by the Thesis Defense Chair in writing to the student, to JCMG&G, and to the Education Offices at WHOI and MIT. When the deficiencies are corrected to the satisfaction of the entire Thesis Committee, that Committee will so specify in a written memorandum from the Chair of the Committee to JCMG&G (with copies to the student and Education Offices), recommending the candidate for conferral of the doctoral degree. The memorandum of final approval must be signed by all members of the Thesis Committee.

Memos and Petitions to JCMG&G

Memos and petitions to JCMG&G requesting such things as committee membership approval, extensions on deadlines, or changes in course requirements must be submitted in writing (hard copy or by email) to the Chair of JCMG&G.

In general, any petition for a waiver of specific degree requirements, or for an extension of time and financial support to complete degree requirements must fully document the justification for the proposed change or extension and must be accompanied by a supporting statement from the student's Advisor(s). Petitions that deal with changing degree requirements at specific dates (e.g. extensions) must be received by the Chair of JCMG&G **at least four weeks** prior to the dates of the proposed change.

Petitions to extend the time for completion of an examination must include the following: (1) a statement of the exceptional circumstances that justify an extension, (2) a firm schedule stating when the examination will be taken, (3) the source of support during the time of extension, and (4) the approval (via separate memorandum) of the student's Advisor(s). An extension of the General Examination will not affect the timing of the Thesis Proposal Presentation, which must be completed by the end of the fifth academic semester, or in special cases only, by the end of the sixth academic semester.

Petitions to extend the time for completion of degree requirements beyond the end of the fifth full year must include (1) a summary of progress to date, (2) justification for the delay, (3) an outline of the components of the thesis with a schedule for completion of each component, and (4) the date when the thesis will be submitted. A student should very carefully assess these factors and decide on a timetable with his/her Thesis Advisor(s). The petition should be approved by the Thesis Advisor(s) in a supporting memorandum, which should also state the source of the student's continuing financial support.

JCMG&G will approve or deny petitions after careful consideration and after consultation with the student's Advisor(s). The petition may be disapproved and/or financial support terminated if there is inadequate justification for the extension or unsatisfactory progress toward completion of the Joint Program requirements. If the petition is denied, the student must either complete the requirements on schedule or withdraw from the program. In some circumstances, the student may be given the option of completing an M.S. degree.

Residence Time/Support

Graduate student financial support will, as a general rule, terminate (1) effective the day the final, revised thesis is submitted to MIT and the WHOI Education Office, (2) at the end of the term in which the five-year nominal appointment is completed, or (3) at the termination date determined in response to any petition the student submits. Under no circumstances can a student receive graduate student funding after their thesis defense has been successfully completed. If a student petitions JCMG&G and is allowed an extension into a sixth year, financial support may be continued at the discretion of his/her Advisor, or at the discretion of the

Education Office if Education funds are needed. Request for financial support for a seventh year is almost always denied.

Consultation Resources for Students

Students are encouraged to talk to people about any difficulties they experience. A student's Advisor(s), the Education Coordinator, or fellow students may help, if they know the student is having difficulty. Other individuals available to the student for consultation are the EAPS Department Chair (MIT), the Geology and Geophysics Department Chair (WHOI), the Joint Program Dean of Graduate Studies (WHOI), the Joint Program MIT Director (MIT), and the Assistant Dean of Graduate Studies at WHOI. The Ombudsperson and Special Assistant to the Director for employee and student relations at WHOI is also available to help a student. In addition to helping with personal problems that may affect a student's academic performance, the Ombudsperson is responsible for affirmative action and for coordinating the substance abuse program at WHOI. Any of the individuals noted above can help a student find professional help if it seems warranted. Individuals initiating an inquiry or complaint will not be reprimanded or discriminated against.

Requirements for a Master of Science Degree

Although there is no formal program resulting in an M.S. Degree in Marine Geology & Geophysics, the decision that a student should terminate his/her studies in the Joint Program with an M.S. degree can be made for a variety of reasons (e.g. a student's personal reasons for not proceeding to a Ph.D.; unsatisfactory performance in formal classes, in completion of General Projects, or in the General Examination, etc.). The point at which this decision is made will depend on each specific case; however, students should typically plan to complete the requirements for a Master's degree within a year of the decision.

The requirements for a Master's Degree are as follows:

- 1) Completion of at least 66 units worth of formal subjects (exclusive of thesis units). These will include the two subjects that are required of all students in MG&G (for which a grade of B or better is required), as well as elective subjects that are recommended by the student's Academic Advisor's and JCMG&G. It is expected that, in most cases, much of this course work will have been completed prior to the decision that a student will terminate with a Master's Degree.
- 2) Completion, and oral presentation of, an acceptable Master's thesis, based on original research by the student. The Master's thesis must make an original contribution to a particular field of study and will likely be based on one of the General Examination Research Topics that have been approved by JCMG&G, and on which the student has already made significant progress.

1. Conduct of Master's Degree Research

As soon as the student has determined a research topic through discussion with his/her Academic Advisors, a Thesis Committee consisting of at least 3 members will be formed. This Committee will include, if possible, at least one staff/faculty member each from MIT and WHOI.

Although the student will work with one (or two) Thesis Advisor(s), this Committee will act as an advisory body during the course of the student's research. The student will take responsibility for keeping all members apprised of his/her progress. The student will also submit a short abstract of the proposed thesis and the members of the Thesis Committee to JCMG&G for approval.

The M.S. thesis will consist of:

1. Abstract;
2. Historical review and background of the problem;
3. Presentation of the original research and its contribution toward solution of the problem
4. Summary
5. Bibliography.

2. Conduct of the M.S. Thesis Presentation

A public presentation of the research represents an opportunity for the student to communicate the result of his/her research, and brings closure to the scientific process. The thesis must be submitted to the Thesis Committee **at least two weeks** prior to the public presentation. In consultation with the Advisor and committee, the student will schedule the presentation and inform the Education Offices at WHOI and MIT of the date, time and location. The Education Offices will then advertise the presentation. It is the Advisor's responsibility to insure that the Presentation is arranged and advertised.

The presentation will be Chaired by the Thesis Advisor and will consist of two parts: (1) a public presentation (typically about 45 minutes long) of the results of the research, followed by a brief public question and answer period; and (2) an informal, private discussion of the research results between the student and the Thesis Committee. Other MIT faculty and WHOI Education Assembly members who have read the thesis may also participate in the private discussion, but do not participate in the Thesis Committee's deliberations on the acceptability of the thesis.

Following the private discussion, the student will retire from the room and the Thesis Committee will determine the acceptability of the thesis and recommend any changes. Once any recommended changes/ revisions have been completed, the student's Thesis Advisor will sign the thesis signifying its acceptance.

Appendices

Appendix I: MG&G Student Progress Report

Appendix II: MG&G Advisor's Report on Student Progress

Appendix III: Guidelines for submitting Application for Admission to Candidacy

Appendix IV: General Examination form

Appendix V: Thesis Defense Form

Appendix I: Marine Geology and Geophysics Student Progress Report

Name: _____

Status (please check one and give details requested):

____ **First year in program.** Note any research you are involved in.

Academic Advisors: _____

____ **Second year.** Give titles of General Examination projects and advisors:

Project 1: title: _____

Advisor _____

Project 2: title: _____

Advisor _____

Are the topics approved by JCMG&G? ____yes ____no

Expected date of General Examination _____

Expected date of Thesis Proposal Presentation _____

____ **Third year.**

Passed General Examination ____yes ____no; date scheduled/passed _____

Completed Thesis Proposal Presentation: ____yes ____no;
date scheduled/passed _____

Thesis Advisor(s): _____

____ **Fourth or fifth year** in program. Expected completion date of thesis _____

Thesis Committee members: _____

Comments:

Below list courses you took over the past year, what grades you received, and whether the courses were useful for you (continue on back side of paper if necessary).

Describe your research activities over the past year (continue on backside of paper if necessary).

Are you satisfied with your progress? Are there any problems you need help with? Would you like to meet with JCMG&G? (continue on back side of paper if necessary)

Date: _____

Signature: _____

Appendix II: Marine Geology and Geophysics Advisor's Report on Student Progress

Advisor Name: _____

Student Name: _____

Student Status (please check one and give details requested):

___ **First year** in program. Note any research the student is involved in.

___ **Second year.**

Have the student's Generals Exam topics been approved by JCMG&G? ___yes ___no

Expected date of General Examination _____

Expected date of Thesis Proposal Presentation _____

___ **Third year.**

Passed General Examination ___yes ___no; date scheduled/passed _____

Completed Thesis Proposal Presentation ___yes ___no;
date scheduled/passed _____

___ **Fourth or fifth year.**

Expected completion date of thesis _____

Comments:

Describe below your student's educational and research activities over the past year (e.g., course work, field work, analyses completed, papers presented at meetings, manuscripts submitted for publication, etc.) (continue on back side of paper if necessary).

Do you feel your student is making reasonable progress in the program?

Do you think it is necessary for you or your student to meet with JCMG&G? (continue on back side of paper if necessary).

Date: _____

Signature: _____

Appendix III: Guidelines for Application for Admission to Candidacy

The Application for Admission to Candidacy should be submitted to the Education Offices at MIT and WHOI and the members of the General Examination Committee. The Application must bear the approval of the student's Academic Advisors via their signature.

The Application should include the following:

- 1) Brief Curriculum Vitae
- 2) List of advisors
- 3) List of subjects taken (course number, name), instructor, and grade. Core courses should be so designated.
- 4) Dates of waivers received from JCMG&G (if any) to change core curriculum.
- 5) List of papers published and papers in press, with copies of the abstracts of each.
- 6) Titles and abstracts of the two research papers completed for the General Examination.
- 7) Membership of the General Examination Committee.
- 8) Potential Thesis Committee members.
- 9) Brief description of proposed thesis research
- 10) Signatures of Academic Advisors

Name of Candidate: _____

Recommendation of the General Examination Committee

- 1) Student proceed to Thesis Proposal Examination: _____
- 2) Repeat Examination: Research Paper(s): _____ Background Knowledge: _____
- 3) Complete M.S. degree: _____
- 4) Terminate graduate-student status: _____
- 5) Other (describe in full below): _____

Date: _____

Signed by: _____, Chair

Appendix V: Thesis Defense Form

Name of Candidate: _____ Examination Date: _____

| Names of the Thesis Defense Committee Members | Initial Grade on Thesis Defense | Final Grade on Thesis Defense |
|---|---------------------------------|-------------------------------|
| Chair: | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Results of Thesis Defense:

Candidate recommended for doctoral degree: _____

Candidate recommended for doctoral degree with qualifications (describe on next page): _____

Fail (comment on next page): _____

Other (describe on next page): _____

Grading is Pass or Fail

(continue on next page)

Appendix V: Thesis Defense Form (contd.)

Name of Candidate: _____ Examination Date: _____

Comments/Qualifications (explain specifically how and when qualifications are to be met):

Date: _____

Signed by: _____, Chair

MIT/WHOI Joint Program MGG Climate/Paleo Track EXAMPLE (see below for more electives)

| Year 1 | | Year 2 | |
|---|---|---|---|
| Fall | Spring | Fall | Spring |
| *12.754 Presenting Scientific Research (WHOI) | 12.740 Paleoceanography (MIT) | +12.747 Modeling, Data Analysis, and Numerical Techniques for Geochemistry (WHOI) | 12.707 History of the Earth's Climate |
| *12.710 Geological Oceanography (WHOI) | 12.753 Geodynamics Seminar (WHOI) | 12.708 Seminar in Paleoclimatology (WHOI) | 12.860 Climate Variability and Diagnostics (WHOI) |
| 12.743 Geochemistry Marine Sediments (WHOI) | 12.849 Mechanisms and Models of Global Carbon Cycle (MIT) | Additional Elective | 12.754 Communicating Ocean Sciences (WHOI) |
| 12.808 Introduction to Physical Oceanography (WHOI) | | | |

*Required course

+A common option to fulfill data analysis requirement

Recommended for most MGG Climate and Paleo students:

12.808 Intro Observational Phys. Oceanography (WHOI)

12.860 Climate Variability and Diagnostics (WHOI)

12.842 Climate Science (MIT)

12.747 Modeling, Data Analysis, and Numerical Techniques for Geochemistry (Satisfies Data Analysis Requirement) (WHOI)

Other Popular Electives (These are not meant to be exhaustive but depend on student interest)

7.410 Applied Statistics (WHOI)

7.47 Biological Oceanography (WHOI)

7.43 Topics in Biological Oceanography (WHOI)

12.110 Sedimentology (MIT)

12.540 Principles of GPS (MIT)

12.707 History of Earth's Climate (MIT)

12.708 Seminar in Paleoclimatology - (topics vary – may be repeated for credit) (WHOI)

12.740 Paleoceanography (MIT)

12.742 Marine Chemistry (WHOI)

12.445 Communications in the Earth Atmosphere and Planetary Sciences (MIT)

12.743 Geochemistry Marine Sediments (WHOI)

12.744 Introduction Marine Isotopes (WHOI)
12.753 Geodynamics (topics vary – may be repeated for credit) (WHOI)
12.757 Climate Change Science: Facts, Questions, Controversies, and Communication (WHOI)
12.463 Geomorphology (MIT)
12.849 Mechanisms and Models of Global Carbon Cycle (MIT)
12.800 Fluid Dynamics of the Ocean and Atmosphere (MIT)
18.03 Differential Equations (MIT)
12.811 Tropical Meteorology (MIT)
12.812 General Circulation of Atmosphere and Climate Change (MIT)
12.814 Aerosol and Cloud Microphysics and Chemistry (MIT)
18.085 Computational Science and Engineering (MIT)
12.801 The General Circulation of the Ocean (MIT)
12.810 Dynamics of the Atmosphere (MIT)

MIT/WHOI Joint Program Geophysics/Geodynamics Track

| Year 1 | | Year 2 | |
|--|---|---|--|
| Fall | Spring | Fall | Spring |
| 12.501 Essentials of Geophysics [MIT] | 12.520 Geodynamics [MIT] | 12.755 Advanced Marine Geophysical Methods [WHOI] | 12.521 Computational Geophysical Modeling [WHOI] |
| +12.710 Geological Oceanography [WHOI] | 12.753 Geodynamics Seminar [WHOI] | 12.525 Mechanisms of Faulting and Earthquakes [WHOI] | 12.522 Geological Fluid Mechanics [WHOI] |
| 18.085 Computational Science & Engineering I [MIT] | 18.085 Computational Science & Engineering II [MIT] | +12.716 Igneous Processes at Oceanic Margins [WHOI] | 12.718 Kinematics & Mass Transfer [WHOI] |
| *12.754 Presenting Scientific Research [WHOI] | *Data Analysis Course (e.g. 12.444, 12.714, 12.747, 12.864) | 18.305 Advanced Analytic Methods in Science and Engineering [MIT] | 12.753 Geodynamics Seminar [WHOI] |

MIT/WHOI Joint Program Seismology Track

| Year 1 | | Year 2 | |
|--|---|---|--|
| Fall | Spring | Fall | Spring |
| 12.501 Essentials of Geophysics [MIT] | 12.510 Introduction to Seismology [MIT] | 12.755 Advanced Marine Geophysical Methods [WHOI] | 12.540 Principles of Global Positioning System [MIT] |
| +12.710 Geological Oceanography [WHOI] | 12.520 Geodynamics [MIT] | 12.712 Advanced Marine Seismology [WHOI] | 12.515 Data and Models [MIT] |
| 18.085 Computational Science & Engineering I [MIT] | 12.753 Geodynamics Seminar [WHOI] | +12.716 Igneous Processes at Oceanic Margins [WHOI] | 12.753 Geodynamics Seminar [WHOI] |
| *12.754 Presenting Scientific Research [WHOI] | *Data Analysis Course (e.g. 12.444, 12.714, 12.747, 12.864) | 18.305 Advanced Analytic Methods in Science and Engineering [MIT] | 18.306 Advanced Partial Differential Equations with Applications [MIT] |

*Required course

+Fulfills breadth requirement

MIT/WHOI Joint Program MGG Coastal Track EXAMPLE (see below for more electives)

| Year 1 | | Year 2 | |
|--|---|--|---|
| Fall | Spring | Fall | Spring |
| 12.463 Geomorphology (MIT) | 12.717 Coastal Geomorphology (WHOI) | 12.110 Sedimentology (MIT) | 12.860 Climate Variability and Diagnostics (WHOI) |
| *12.710 Geological Oceanography (WHOI) | 12.753 Geodynamics Seminar (WHOI) | 12.862 Coastal Physical Oceanography | 12.754 Communicating Ocean Sciences (WHOI) |
| 12.808 Introduction to Physical Oceanography (WHOI) | Additional Elective | +12.747 Modeling, Data Analysis, and Numerical Techniques for Geochemistry (WHOI) | Additional Elective |
| *12.754 Presenting Scientific Research (WHOI) | | 12.811 Tropical Meteorology (MIT) | |

*Required course

+A common option to fulfill data analysis requirement

Recommended for most MGG Coastal students:

12.717 Coastal Geomorphology (WHOI)

12.862 Coastal Physical Oceanography

12.860 Climate Variability and Diagnostics (WHOI)

12.747 Modeling, Data Analysis, and Numerical Techniques for Geochemistry (Satisfies Data Analysis Requirement) (WHOI)

Other Popular Electives (These are not meant to be exhaustive but depend on student interest)

1.106 Environmental Fluid transport and Hydrology Lab (MIT)

1.061A+B Transport Processes for the Environment (MIT)

1.1385 Wave propagation (MIT)

1.64 Physical Limnology (MIT)

1.69 Introduction to Coastal Engineering (WHOI/MIT)

1.692 Ocean Wave Interaction with Ships and Offshore Energy Systems (MIT)

1.76 Aquatic Chemistry (MIT)

1.95J Teaching College-Level Science and Engineering (MIT, co-listed in other departments)

2.016 Hydrodynamics (MIT)

7.410 Applied Statistics (WHOI)

7.43 Topics in Biological Oceanography (WHOI)

7.47 Biological Oceanography (WHOI)

11.0025 Making Public Policy (MIT)

12.110 Sedimentology (MIT)
12.307 Weather and climate lab (MIT)
12.333 Atmospheric Dynamics (MIT)
12.340 Global Warming Science (MIT)
12.445 Communications in the Earth Atmosphere and Planetary Sciences (MIT)
12.463 Geomorphology (MIT)
12.507 Environmental Geophysics (MIT)
12.540 Principles of GPS (MIT)
12.586. Modeling Environmental Complexity (MIT)
12.707 History of Earth's Climate (MIT)
12.708 Seminar in Paleoclimatology - (topics vary – may be repeated for credit) (WHOI)
12.757 Climate Change Science: Facts, Questions, Controversies, and Communication (WHOI)
12.740 Paleoceanography (MIT)
12.742 Marine Chemistry (WHOI)
12.743 Geochemistry Marine Sediments (WHOI)
12.744 Introduction Marine Isotopes (WHOI)
12.753 Geodynamics (topics vary – may be repeated for credit) (WHOI)
12.800 Fluid Dynamics of the Ocean and Atmosphere (MIT)
18.03 Differential Equations (MIT)
12.808 Intro Observational Phys. Oceanography (WHOI)
12.811 Tropical Meteorology (MIT)
12.812 General Circulation of Atmosphere and Climate Change (MIT)
12.814 Aerosol and Cloud Microphysics and Chemistry (MIT)
12.842 Climate Science (MIT)
12.849 Mechanisms and Models of Global Carbon Cycle (MIT)
18.085 Computational Science and Engineering (MIT)

MIT/WHOI Joint Program Petrology Geochemistry Track

| Required classes | | | |
|---|---|---|--|
| Recommended for most MGG Petrology Geochemistry students | | | |
| Other classes of interest (not exhaustive) | | | |
| Odd year (eg 2015) | | Even year (eg 2016) | |
| Fall | Spring | Fall | Spring |
| 12.710 Geological Oceanography [WHOI] | 12.753 Geodynamics seminar series [WHOI] | 12.754 Presenting Scientific Research [WHOI] | 12.749 Solid Earth Geochemistry [WHOI] |
| 12.754 Presenting Scientific Research [WHOI] | 12.521 Computational Geophysical Mod [WHOI] | 12.716 Essentials of Oceanic Petrology [WHOI] | 12.520 Geodynamics [MIT] |
| 12.718 Kinetics and mass transport [WHOI] | | 12.480 Thermodynamics for geoscientists [MIT] | |
| 12.490 Advanced Igneous petrology [MIT] | | 12.501 Essentials of Geophysics [MIT] | |
| | | 12.744 Marine Isotope Chemistry [WHOI] | |
| Timing TBD | | | |
| *Data Analysis Course (e.g. 12.444, 12.714, 12.747, 12.864) | | | |