

Program Review:
Department of Geology and Geophysics (G&G)
In The School of Ocean and Earth Science and Technology

Council on Program Review
University of Hawaii at Manoa
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DRAFT

Review Panel:
Tom Olson (Nursing), Convener
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Introduction/Procedures

The three-member review panel was formed by the campus-wide Council on Program Reviews and commenced review activity in February 2001.

The primary document used for this review was the 21-page **Self Study Report**, completed during Summer 2000, by then Chair David Bercovici. The review panel also collected the following supplementary information:

- Summary of the last program review completed in 1990.
- Documentation of the professional activity of the faculty.
- Current undergraduate student surveys (15 collected through the department)
- Current graduate student surveys (11 collected through the department)
- Interviews/Discussions (date of interview in parentheses):
 - Dr. Paul Wessel, Chair since January 2001 (February 7)
 - Faculty (February 14; attended by 20+ faculty)
 - Graduate Students (February 28; attended by 20+ graduate students)
 - Undergraduate Students (March 7; attended by 12 undergraduate students)
 - Dean C. Barry Raleigh and Interim Associate Dean Pat Cooper (March 21)
 - Inspection of the facilities with Dr. Paul Wessel and Instructor, Ms. Patty Lee (May 3)

It is important to note that at all of the stages of information collection, the atmosphere among administrators, staff, faculty and students toward the review team was one of openness and cooperation.

Overview of the Program

Geology has a long history within the university, having been taught since 1920, organized into a department in 1955, and then renamed Geology and Geophysics (G&G) in 1959. Subsequent changes included the initiation of a graduate program, in 1962, and eventual separation of meteorology and oceanography into separate departments (see the **Self Study Report** for a more detailed history). The department fits well into the University of Hawaii, Manoa campus role as a premier research institution. And it is well-placed to take advantage of the region's combined volcanic and marine environment, surrounded by the most seismically active zone on earth.

Four degrees are offered by the department, including a B.S. in Geology and Geophysics ("for students planning to be "professionals"); B.A. in Geology ("for students not planning to become professional geoscientists"); M.S. in Geology and Geophysics; and a Ph.D. in Geology and Geophysics. The Department offers no certificate programs. At the time of

the self study, there were six area of research emphasis. However, during Fall 2000, these were reorganized into four areas, to better reflect the composition of the faculty. The four areas of emphasis are as follows:

- Geophysics and Tectonics
- Volcanology
- Marine and Environmental Geology
- Planetary Science

The last area, however, is primarily covered by graduate faculty from the Hawaii Institute of Geophysics and Planetology (HIGP). Only the first three areas are listed on the department's web site as areas of emphasis wholly within G&G.

Program Objectives

The **Self Study Report** identified four broadly-focused objectives, focusing on maintaining high quality undergraduate and graduate programs; serving non-majors in their survey courses; conducting high quality, relevant research; and assisting and advising the public in areas of expertise. In the review team's discussions with all of the various groups above, the central nature of these goals was regularly stressed.

Curricula

In addition to the description of the G&G curricula in the University of Hawaii at Manoa General and Graduate Information Catalog, it is also described in a visually interesting and up-to-date web page (<http://imina.soest.hawaii.edu/GG>). As noted, the department offers BA, BS, MS, and PhD degrees.

Undergraduate Programs. The undergraduate curriculum was revised, effective Fall 2000, and a transition plan for current majors was implemented. This new curriculum is intended to be more focused, providing a bridge between freshman and junior level courses and making a clearer distinction between the BS and BA degrees. The BS in Geology and Geophysics is now described as intended for "students who are prepared for and desire a rigorous education in geology and geophysics" and who plan to continue their education in the earth sciences at the graduate level. This program, in contrast to the BA, requires a second semester of calculus. The BA program is "more flexible and has a larger number of electives." It is intended for students who "do not necessarily" plan to pursue graduate work or employment in "traditional geology fields." The BA is considered preparation for other areas, such as land-use planning, science teaching in secondary education, and work in environmental law.

Graduate Programs. As outlined above, areas of emphasis for graduate students follow the general divisions of researchers and research activities within the department. These include Marine and Environmental Geology; Geophysics and Tectonics; and Volcanology, Geochemistry, and Petrology. G&G graduate students whose research focuses on high

pressure geophysics and geochemistry and planetary geosciences have main faculty advisors from the SOEST's Hawaii Institute of Geophysics and Planetology.

For MS students, the graduate work committee of the department determines the suitability of Plan A (thesis) or Plan B (non-thesis) at a preliminary conference. Virtually all students, however, are required to follow Plan A. Plan A requires a minimum of 30 credits, including 6 credits of G&G 700 Thesis Research and at least 24 credits of course work (up to 6 course work credits may be in GG 699).

PhD students are accepted with either a BS or MS degree. Students without an MS must pass a qualifying examination given at the beginning of their second semester of residence. All PhD candidates must pass a comprehensive examination no later than at the end of the fourth semester of residence for students without an MS degree or at the end of the second semester of residence for students with an MS degree. The comprehensive examination includes oral and written parts that cover in-depth those subjects in the student's field of interest and also the breadth of several areas in this and other departments that bear on the field. A final examination in defense of the dissertation is required.

Strengths and Weaknesses. G&G offers a rich and varied array of courses in overall curricula that challenge students and, particularly at the graduate level, prepare them to be leaders in their field. The active and in-depth involvement of faculty and students in various research programs provides a very important, yet easily overlooked stimulus to the curriculum. It means that overall programs, as well as individual courses, are regularly updated by cutting edge insights and ideas. The fact that all graduate students are fully funded, most as research assistants from faculty research grants, contributes to an invaluable sharing of knowledge and expertise, both in formal classroom settings and outside the classroom.

Faculty, students and administrators all noted that the loss of five individuals during Fall 2000, four faculty members and one specialist, created significant difficulties in relation to the curriculum. In particular, the rather sudden loss of these individuals has meant increased teaching loads for faculty, a decrease in graduate course offerings, and a disruption in some student research programs (see also "Faculty" and "Students" below). In regard to the last difficulty, students expressed a need for "more of a safety net when students are abandoned by their advisor." At the time of the review, the department was actively seeking to fill these vacant positions.

Faculty

In the decade following the last program review, in 1990, the previous Department Chair (Dr. Bercovici) reported that the number of G&G faculty positions (regular graduate faculty) decreased from 18.75 to 15.25, a decrease attributed to "positions not being replaced

after retirement or death and transfer of positions from G&G to HIGP after the formal establishment of SOEST.” A further, dramatic decline in total faculty, although not in the actual number of positions, occurred in Fall 2000, when four regular graduate faculty and one specialist left the department. One faculty member left for retirement, however, the remaining four left for other positions (two went to other universities; one assumed a national government position; and one left for private industry).

According to recent figures from the current Chair (Dr. Wessel), the steady reduction in total faculty has been replaced by a notable increase. As of August 1, 2001, the G&G faculty roster includes 14 tenured full professors, 4 tenured associate professors, 1 tenure-track assistant professor, 2 non-tenured specialist faculty (this includes a recent resignation for which a replacement is currently being sought), and 1 part-time instructor. In addition, on January 1, 2002, the Department will welcome two new tenure-track assistant professors and a half-time non-tenure track assistant researcher. Further, there is an ongoing search for a paleoceanographer, providing the potential for one more tenure-track assistant professor by August 2002. Complementing the departmental faculty is a large group of graduate faculty from other SOEST units who support the department by advising students, hiring graduate and undergraduate students and occasionally teaching a course.

Faculty described their workload as heavy, but fair. All faculty, including those with an “R” appointment, teach at least one course per semester. It should also be noted that all new hires, according to the Chair, will henceforth only be brought in with an “I” appointment. The previous review, in 1990, indicated a problem in regard to the fact that “no credit is given for advising graduate students.” Although this may have general implications in regard to how a department’s workload is viewed within the university as a whole, a point raised in the 1990 review, current faculty themselves reported that this is “a non-issue” within their department.

A review of the faculty profiles and CVs highlights the fact that this is a highly productive faculty, not only in terms of teaching and advising, but also in regard to publications and research. Members publish an average of 2-3 papers per year in refereed journals and bring in \$2.5 to \$3 million in extramural grants per year (\$2,811,500 during fiscal 1999-2000). The review team’s interaction with faculty, both individually and in the group meeting, further emphasized that this is a dynamic and highly engaging group of scholars. Three faculty are recipients of the Regents Medal of Excellence in Research and three have received a Regents Medal or Presidential citation for excellence in teaching. The quality of their teaching and research is also consistently rated highly by students, as shown in the student surveys (see Undergraduate and Graduate Student Survey Results, pp. 11-14) and during the interviews.

Faculty serve on panels of the National Science Foundation and the National Academy of Science, as well as participating in planning mission for NASA and serving in various professional societies (e.g. the American Geophysical Union, Geological Society of

America and The Royal Society of London). Within the local community, faculty make outreach visits to public high schools and elementary schools. And they are working with the Hawaii Department of Education on the curriculum for a proposed "E-School," intended to enhance science teaching at the secondary education level.

Strengths and weaknesses. As already noted, this is a dynamic and highly productive faculty. Administrators and faculty alike, however, expressed concern about the number of faculty leaving during Spring 2000 and the negative impact this had in terms of teaching load, graduate course offerings, graduate student advising and research, and overall morale. In addition, the current faculty includes only one junior member, although two additional tenure-track assistant professors will begin in January 2002. As one individual explained, there is a shortage of "new blood," that is, junior faculty who can help to ensure the department's continued high level of accomplishment. The aging of the faculty is further highlighted by the fact that for the seven year period ending in Spring 2000, the department added only four new faculty members, one of whom was a transfer from another program in SOEST.

The 1990 review emphasized that G&G is "a male dominated profession (and) the department should be encouraged in their efforts to hire qualified females and minorities." Administration and faculty were open in discussing this concern and the fact that the department remains almost entirely male, with only one female graduate faculty member. This is despite the fact that nationwide approximately half of all G&G graduate students are female. For reasons that are not clear, faculty explained that fewer females elect to pursue careers in academia. Moreover, the pool for the highly specialized applicants sought after by the department is quite limited and qualified female and minority applicants are greatly sought after. Administration explained, however, that a female applicant currently is being considered for one of the vacant positions.

in addition to the issue of replacing positions, faculty identified university administration (Bachman Hall) as a major concern, particularly in regard to fiscal policy. Members explained that funding cuts have meant that they must subsidize their teaching with research funds, buying equipment used in teaching with research funds. In addition, there was general agreement that more teaching assistant positions are needed (the department is currently allotted four teaching assistant positions), as well as a technician to ensure that the proper functioning of the department's equipment.

Students

G&G is unique from many other departments in regard to the fact that graduate students tend to outnumber undergraduate students, two to one. As of Spring 2001, there were approximately 30 undergraduate and 60 graduate students enrolled in the department's programs. Both groups were open and very vocal during the interviews with the review team.

Applicants for the graduate program are recruited internationally, in a very competitive process, which included 86 applicants for approximately 15 openings for the upcoming year. Graduate students are accepted only if fully funded, either by faculty research grants and/or as a teaching assistant. The student group is diverse, including foreign and U.S. students, approximately half of whom are women. However, none of the students interviewed originally came from Hawaii, a finding that matches with reports from faculty and administration that local students seldom gain admission to the program. Like the undergraduate students, graduate students consistently rated the quality of teaching and research in the department as high (see Undergraduate and Graduate Student Survey Results, pages 11-14).

Undergraduate students are more likely to be local, although this group also includes foreign students and individuals from the mainland. And despite the doubtful chances for local students being admitted to the program, those interviewed were unanimous in stating that their eventual goal was to pursue graduate study in G&G at the University of Hawaii. Faculty and administrators explained that the public education system in Hawaii, from which most of the local students in G&G come, does not seem to adequately prepare the students for the rigors of graduate study in this department. In addition, most faculty agreed that in order to enrich a student's experience, it is most desirable that those who complete their undergraduate G&G education at UH are best served by pursuing their graduate education at other universities.

The information in the Chair's report on attrition rates was somewhat confusing. It is first noted that "we have not kept statistics on the number of students who have finished vs. dropped out of our program." However, the statement is then made that "over the last five years, there are 79 declared majors," 71% of whom graduated. The report did not explain if this total applied to graduate and/or undergraduate students. And the report subsequently noted that "over the last five years, 55 graduate students completed their theses and graduated. Twenty-one students dropped out. Thus, our attrition rate is 28%." Of course, the correct figure here is actually 38%.

Strengths and weaknesses. During the interviews, the graduate students were engaging, open and highly articulate. They are a select group of individuals, as noted above, whose general enthusiasm, motivation and academic excellence certainly adds to the overall dynamism of this department. The undergraduate students also seemed very open, and were quite verbal and energetic. However, given their unanimous goal of entering the G&G graduate program at UH, and the fact that few if any will realize this goal (see above), the department may want to assist students by clarifying actual opportunities, e.g. by making known the usual number of undergraduates accepted into the graduate program. Graduate students also suggested that they would like to have more opportunities for interaction with undergraduate students.

The general lack of outstanding undergraduate students, as described in the department report and during the interviews, suggests a need for recruitment efforts aimed at the most highly qualified high school students in Hawaii. This may mean recruiting not only in public schools, which the department currently does at both elementary and high school levels, but also in private schools, which according to administration has not been a focus. Dean Raleigh noted, however, that SOEST is planning “to do more with private schools.”

Another area of concern was apparent from the written survey of graduate students (see Graduate Student Survey Results, pages 13-14). In responding to item no. 15 (“There are no problems of harassment or coercion in the department.”), half of the eleven respondents disagreed or strongly disagreed with the statement, and one responded “uncertain.” Unfortunately, this finding emerged after the meetings with students and faculty, and so was not directly addressed during the interviews. A possibly related concern was indicated by the five out of eleven respondents who disagreed that “program requirements are consistent for all students.” Students did suggest that problems in communication may be part of these difficulties, noting that “more formal advisement is needed between graduate students, faculty, and the department,” regarding such issues as vacation, pay and responsibilities. Several individuals added that “there needs to be more follow through . . . more organization,” since whether or not a follow up is made to suggestions seems to an “arbitrary matter.”

Facilities

G&G is located in the POST building, a relatively new addition to the UH campus. The review team’s tour of the facilities revealed excellent classroom, laboratory and seminar space. Classrooms range from large lecture halls, which can accommodate more than 100, to rooms for groups of ten or less. Laboratory facilities include separate teaching labs for mineralogy/petrology and introductory earth science courses.

The analytical and experimental research laboratories include the following highly technical equipment and facilities:

- Radiogenic Isotope Facility, which additionally comprises:
 - VG54-WARP multi-collector high-abundance-sensitivity thermal ionization mass spectrometer (TIMS) for positive and negative ions analysis;
 - VG Sector multi-collector thermal ionization mass spectrometer;
 - High resolution Alpha Spectrometry system;
 - Class 1000 clean laboratory;
 - Radioactive-isotope tracer and dating facilities;
- Cameca SX-50 Electron Microprobe;
- VG Plasmaquad II+ ICP-MS with laser;
- Siemens SRS-303 Automated X-ray;
- Fluorescence Spectrometer (XRF);

- Light Isotope Facility, which additionally comprises:
 - Stable isotope mass spectrometers;
 - Varian GC/MS system stable isotope lab;
- Sedimentology, paleontology, and paleomagnetism (including a 3-axis cryogenic magnetometer) laboratories;
- Hydrogeology laboratory, fluid mechanics laboratory, soil and rock mechanics testing laboratory;
- Instruments for measuring electrical conductivity on rocks or rock melts, thermal conductivity and thermal expansion, porosity and gas permeability;
- Thin section and rock preparation labs;
- Crystal cutting and polishing facilities.

The department also has excellent computer facilities for its students, including 30 work stations, with 24-hour access, in three computer rooms (ten windows PC and ten MAC workstations, plus ten Sun Ultra Sparc unix workstations). All are networked and have open access to the internet and a number of free-use peripherals such as postscript laser printers and digital scanners. In addition, color printing and color slidemaking are available to graduate students through their advisor. Overall, the student to computer ratio in the department stands between 3 and 4. The computer facilities were in active use on both days during which they were observed by the review team. In addition to these facilities, SOEST has approximately 100 other work stations of various types in various laboratories, including a Cray mini super computer and a number of silicon graphics work stations, all of which are available to students through arrangement with the director(s) of the individual labs.

Through SOEST, G&G also has available several research vessels and their supporting shipboard technical group, which can be used for gathering geophysical, geochemical and other open ocean and coastal data and samples. Sea-going instrumentation includes equipment for digital seismic reflection, gravity, magnetism, coring, dredging, and water column studies, the HAWAII MR1 side-scan sonar system, and fiber optic-based deep-towed FOCUS camera system. Software is also available for multi-channel seismic processing and geophysical data analysis. Finally, other facilities available to G&G faculty and students, through SOEST, include the following:

- Engineering Support Facility (electronic and mechanical engineering;
- Modern machine shop with CRC and HURCO milling; electronics shops);
- Core and dredge collections;
- Geophysical data archives;
- Pacific Regional Planetary Data Center;
- SOEST research library;
- SOEST Publications Facility (staff for professional editing, drafting, design, photography, and layout);
- Computer facilities for desktop publishing, including color publication;

- Two deep research wells and a shallow test well field;
- Geophysical well-logging system, evapotranspiration research station, and stream gaging station.

Strengths and weaknesses. The G&G equipment and facilities are very impressive, although essential to maintaining a position of leadership within the field. As faculty and administration pointed out, however, having the necessary equipment and facilities is only one aspect of success. Another crucial aspect is having the technicians and service contracts to ensure the proper functioning of the equipment and facilities. And yet, Dr. Wessel noted that the department has been unable to afford the added expense of hiring technicians and/or purchasing service contracts. Thus, at present, G&G is largely “making due” with individual faculty taking care of equipment and facilities that they use and “hoping that nothing major goes wrong.” Specific difficulties that the department is in the midst of correcting include ventilation problems in one research laboratory. More generally, it was also apparent during the tour of the facilities that, despite the newness of the building, there is an obvious problem with the air conditioning system, with some classrooms and areas overly cool and others too warm. Faculty reported that this has been a continuing challenge.

Conclusion and Recommendations

G&G is a highly productive and successful unit within SOEST and the larger university. Evidences of its dynamism include the ability to attract outstanding graduate students, generate important and financially rewarding research grants, produce numerous and significant publications, provide valuable service to the larger community, and undergo a reorganization that has helped to focus the expertise of the faculty while also communicating this expertise more clearly to students. To maintain its position of excellence, it is crucial, as faculty, students and administrators pointed out, that open positions continue to be filled with dynamic scholars in the early part of their careers, in accord with the recent hires. Along with supporting the department in this effort, especially in terms of being able to offer competitive salaries, the review team recommends the following:

- continued attention must be paid to increasing faculty diversity;
- undergraduate recruitment efforts should include private as well as public schools;
- a more accurate and less confusing accounting of student attrition should be initiated;
- an immediate effort should be undertaken to understand the basis for students’ concerns about harassment and coercion and quick action should be taken to remedy any difficulties in this regard;
- funding should be provided for the necessary technicians and service agreements to ensure continued smooth operation of the department’s complex facilities and highly technical equipment.

PROGRAM REVIEW STUDENT QUESTIONNAIRE - G&G UNDERGRADUATE RESULTS

N=15 (note missing responses for questions 2, 3, 16, & 18)

Questions	Strongly Agree	Agree	Disagree	Strongly Disagree	Uncertain
1. The program is selective in its admission of students.	2	5	2	1	5
2. The length of time needed to complete the program is reasonable.		6	2	3	1
3. Student attrition in the department is low.		6	3	1	4
4. Students generally begin study in the program with little or no academic deficiencies.		4	5	1	5
5. Students are provided with adequate information regarding program and graduate requirements.	4	9	1		1
6. Program requirements are consistent for all students.	5	4	2		4
7. The sequence of courses offered by the department is useful.	2	10	2		1
8. The program includes a sufficient numbers of courses that prepare students for advanced degrees.	3	9	2		1
9. Faculty advising is sufficient in helping students attain their goals.	6	7	2		
10. Students participate in the department's decision making activities.	5	8	1		1
11. The dept. provides an open environment for addressing legitimate student complaints.	2	6	2	1	4
12. Students in the program are provided an opportunity to evaluate their courses.	4	9	1		1
13. The quality of teaching in the dept. is high.	6	8	1		
14. The quality of faculty research is high.	12	3			
15. There are no problems of harassment or coercion in the dept.	9	4	1		1
16. Student morale in the dept. is high.	4	9	1		
17. The quality of the program is sufficiently high to attract students.	4	8	2		1

18. If I could start over, I would choose this major again.	6	4	1		3
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Demographic Characteristics of GG Undergraduate Survey Respondents:

- 6 females; 9 males
- Mean age: 25.2 (with 4 not responding); age range: 20-35
- Mean years in program: 1.9; range for years in program: 1-4

GG Undergraduate Survey Comments:

- Regarding question no. 2: “Too many non-geology classes.”
“Too much time spent on non-geo classes.”
- Regarding question no. 4: “Need more computer pre-reqs.”
- Regarding question no. 7: “Few 100-200 level classes.”
- Regarding question no. 8: “Too many classes.”
- Regarding question no. 13: “Varies--some are.”

PROGRAM REVIEW STUDENT QUESTIONNAIRE - G&G GRADUATE RESULTS

N=11 (note missing response for question 16)

Questions	Strongly Agree	Agree	Disagree	Strongly Disagree	Uncertain
1. The program is selective in its admission of students.	2	8			1
2. The length of time needed to complete the program is reasonable.		8	2		1
3. Student attrition in the department is low.	8	1			2
4. Students generally begin study in the program with little or no academic deficiencies.		5	6		
5. Students are provided with adequate information regarding program and graduate requirements.	4	6	1		
6. Program requirements are consistent for all students.	4	2	5		
7. The sequence of courses offered by the department is useful.		6		4	1
8. The program includes a sufficient numbers of courses that prepare students for advanced degrees.	3	4	3	1	
9. Faculty advising is sufficient in helping students attain their goals.	4	5	1	1	
10. Students participate in the department's decision making activities.	1	5	3	1	1
11. The dept. provides an open environment for addressing legitimate student complaints.	2	5	1	3	
12. Students in the program are provided an opportunity to evaluate their courses.	4	5	1	1	
13. The quality of teaching in the dept. is high.	4	4	3		
14. The quality of faculty research is high.	7	4			
15. There are no problems of harassment or coercion in the dept.	3	2	4	1	1
16. Student morale in the dept. is high.	3	4	3		
17. The quality of the program is sufficiently high to attract students.	5	5	1		

18. If I could start over, I would choose this major again.	7	1	2		1
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Demographic Characteristics of GG Graduate Survey Respondents:

- 5 females; 6 males
- Mean age: 25.8; age range: 22-28
- Mean years in program: 2.8; range for years in program: 1-5

GG Graduate Survey Comments:

- Regarding question no. 4: "Not a bad thing though."
- Regarding question no. 8: "Depends on the area."
- Regarding question no. 9: "Depends on the advisor; some are great, some are terrible."
- Regarding question no. 16: "Varies--some are high, some are low, depends on how their advisors treat them."