

Selecting and Applying to Geoscience Graduate Schools

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Introduction

The decision to attend graduate school should be made based upon your individual career and life aspirations. As a student of the geosciences you may find yourself applying to departments outside of your undergraduate major such as law, engineering, policy, business, or other graduate departments. Additionally, many students with undergraduate majors in departments such as physics, engineering, geography, or chemistry may find themselves applying to geology graduate departments. Regardless of your undergraduate background this document was written to be a guide for the careful selection and application to graduate programs in the geosciences. This guide is not an all inclusive document and indeed the most important recommendation herein is probably to **develop mentoring relationships**. Mentors can help you make these sorts of important decisions as you move forward in your professional career.

The American Geological Institute (AGI) published a comprehensive report discussing the state of the geosciences workforce including industry and the academe (<http://www.agiweb.org/workforce/reports.html>). This 2009 report discusses trends in federal funding for different subfields of the geosciences and employment sectors that you may want to think about as you are pondering how to further your education. However, you should **choose a graduate program based on your greatest interests** because research is a consuming activity and doing it without sincere interest can result in quick burn out. That being said there are many variables in choosing a graduate program.

Assessment #1: Masters or Ph.D.?

The first assessment should probably be: do you want a Masters Degree or a Ph.D.? In either case, the starting salary is generally much higher for someone with a graduate degree. However, starting salaries for a Ph.D. are often not much higher than persons with a Masters. This is because the majority of Ph.D. recipients are bound for academia and assistant professorships or post-doctoral research positions that often pay little more than entry-level positions in industry. Of course, the ceiling of Ph.D. salaries is much higher and Ph.D.s ultimately may lead to more authoritative positions.

Deciding to enter a Ph.D. program straight from undergrad should be carefully thought over. If you are certain of your passionate calling for research and you have ideas about which research questions to answer during your dissertation then directly entering a Ph.D. program may appropriate. To get some reassurance you should feel comfortable enough with a mentor to **ask for some assessment of your preparation level**. Don't forget that you can get a Masters and then move on to the Ph.D.

Many students decide to get some “real world” experience prior to entering graduate school and that can be a good choice. However, many employers prefer that students have a Masters Degree for entry level positions because completing a graduate degree signifies that you have shown ability to generate knowledge independently and can be effective at communicating scientific information. Often students fresh out a

Bachelors degree have found a subfield within the geosciences that really interests them, but they have not attained enough disciplinary information to determine the relevant research questions of the subfield. These students may be academically ready for a Ph.D. program, but some may be uncertain enough that they are not ready to commit 4-8 years of their life until they try it out with a Masters degree. Choosing to enter a Masters program is a sound choice and should prepare you well for continuing in a Ph.D. program. Again, you should work with a mentor to get advice on what programs will best fit your interest and experience. But, be aware that once you enter the “real world,” it can be hard to come back, in particular because of the decrease in salary you may see, especially if you have greater personal responsibilities, like a family.

Choosing an Institution and Advisers

There are hundreds of Universities in the US that award graduate degrees in the geosciences. So how should you select one? Once again your best resource may be suggestions from people who know your abilities and know the field of geosciences well enough that they can give you some leads on good graduate programs and advisers. Choosing programs based upon potential advisers is a very reasonable way to go about selecting departments for application. However, when doing this you need to **establish communication with that potential colleague/advisor**. This could be through an introduction from one of your professors or via email communication about your research ideas. By starting a line of communication you are ensuring that your application will be given careful consideration. Additionally, you will begin to envision what it would be like to work with those individuals. Make sure to keep an open mind and cast the net broadly. Your own preconceptions about places and people may not bear out once you get to know them. Great opportunities may present themselves from surprising sources.

Some Ph.D. granting geosciences departments have well renowned programs in specific areas such as hydrology at Colorado State University, or Oceanography at Scripps at UCSD. There are many programs that are highly thought of for a variety of geoscience fields such as Harvard, MIT, CalTech, Stanford, Washington, Berkeley, UCLA, Wisconsin, Michigan, and quite a few others. For some perspective, ASU is ranked at #31 overall and #17 among public geoscience Graduate departments. (<http://grad-schools.usnews.rankingsandreviews.com/grad/geo/search>).

There are ~600 geoscience Ph.D. recipients nationwide every year (many of them coming from “top schools”) and many more at top international schools. Thus, you should remember that many of the important scientists in your field cannot all be employed at the “top schools” or necessarily in the USA. So you must do your homework (internet searches, science literature, word of mouth) to determine who you could work with. If your ultimate goal is to work at a top research university, then you will want to select an adviser that is well-established in their field. Doing your homework also is a measure of your earnestness which will be manifest positively when you apply and talk with potential advisers.

According to the latest AGI report there are 268 US institutions granting Ph.D.s in geosciences, however faculty of those 268 institutions attained their degrees from only 97 schools. Thus, if your ultimate goal is a professorship with an emphasis on research then you should be selective with your graduate school applications. That being said, there are

many colleges and universities that do not grant geoscience Ph.D.s and many of those faculty come from the other aforementioned other 171 institutions.

Excellent research is not only done at Ph.D. granting institutions. Many well-thought of scientists are professors in departments that grant only Masters Degrees and still more teach at undergrad only schools. These departments typically place much more emphasis on pedagogy, however many professors still find time for contributing to ongoing scientific research. Students of these institutions often find themselves receiving more attention than those in larger Universities and these schools can serve as a preparatory gateway for acceptance at high-powered Ph.D. programs. Additionally, many Ph.D. granting institutions offer Masters Degree options or a Masters in passing on the way to completing your Ph.D. These types of institutions can be a good option for the student with has a strong inclination towards a Ph.D., but is unsure. Additionally, these departments are usually larger and diverse in scope, so they can be a good choice for students who are still seeking a specialty.

Students who are seeking entrance to graduate school and are absolutely certain that they do not want a Ph.D. they might look to select an adviser and program where the non academic track is embraced. This is because classroom, research, and professional foci will be more geared toward preparing you for industry. However, students may want to stay at the most-proximal University to their employment, friends, or family. This is understandable, but you should make sure your adviser understands your career intent from the start so that both of your expectations are met.

Application Materials

A typical checklist of application materials includes:

- 3-4 letters of recommendation
- Graduate Record Exam (GRE) scores
- Transcripts for all previous coursework
- Demographic and contact information
- Curriculum Vitae (CV)
- Letter of interest (sometimes with structured questions)
- Application Fee
- Sometimes there are supplemental materials

Typically, these days, at least part of your application will be electronic, but some departments require hard copy supplemental material. There is no general graduate application so make sure to read all instructions carefully. Often you need to send materials to both the departmental program and a graduate college at the same university.

Cost of Applications

- GRE Exam ~150\$ (a limited number of school reports included)
- GRE score report (~20\$/School)
- Application fee (varies, but expect 50\$/School)

A minimum of 3 applications is advisable and this will be about \$300. However, fees can easily exceed \$600 depending upon the number and types of departments.

Graduate Record Exam (GRE)

The GRE is the standardized test for graduate school akin to the SAT. For some fields there are GRE subject tests such as in Physics or Chemistry. There was a Geology subject test, but it has been discontinued. If you are highly proficient in a science subject (i.e. physics) other than geology it may help your application if you take and perform well on that GRE subject test. However, it is rarely required.

The basic GRE test consists of three sections: verbal, quantitative reasoning (math), and analytical writing. The verbal and quantitative sections are scored out of 800 points (like the SAT). In general the mathematics portion of the GRE is not much more demanding than the SAT and students in the sciences tend to perform very well relative their raw SAT math scores. However, the verbal portion of the GRE exam is much more advanced than the SAT and students in the sciences tend to have a lower raw score. However, universities look at your percentile rank, not raw score, relative to other applicants to your field of study when assessing your GRE scores. The writing section is scored on a 6 point scale. For GRE takers with intended graduate degrees in geology the mean scores are Analytical Writing is 4.3; Verbal is 497; and Quantitative is 624. Very good scores are above Analytical: 4.5; Verbal: 600; and Quantitative: 700.

http://www.ets.org/Media/Tests/GRE/pdf/gre_0809_guide_web_table%204.pdf

There are many test preparation services for the GRE and these can be useful for some, but they are usually unnecessary. Spending more time on your letters of interest and expanding your disciplinary knowledge will likely be more useful than boosting your GRE scores by 40 points. That being said you should definitely take 1-2 home practice exams so you can know what to expect prior to the exam. This is also advised because sometimes you can totally bomb a section (e.g., I have a friend who went from 380 verbal to 560 between two tests); if you have taken 1-2 practice tests then you will know if your test score was way off. This is probably the only good reason to take the GRE twice. Additionally you might be able to predict where your scores fit with the schools you are applying to. If you have aspirations of a top department, but have scored less than excellent on the GRE then you might also apply to some less prestigious departments. To learn more about scheduling GRE exams you should visit their website: <http://www.ets.org> . Take this test well in advance of your application deadlines. However, prior to taking it you should know 4 places where you intend to apply because they provide 4 free score reports that you must indicate at the time of the test.

Transcripts

Transcripts are often required for both the department and graduate college where you are applying. So you may need to order quite a few of these. Generally you must submit official unopened transcripts that have a university seal on the envelope. It is not a bad idea to have a few on hand for last minute applications, but they can be sent directly from your school via an online order form and this probably the most official way to do it. The prices for transcripts can vary significantly. Some schools charge per transcript and others only charge per order. On per order cases you should just stock up. Depending upon your academic background you may have to track down transcripts from several schools you have attended (not your high school), but community college, your field camp school, an REU school, as well as your home institution. So be prepared!

Curriculum Vitae (CV)

A CV is similar to a resume except in the content emphasized. A CV is not necessarily required by all schools, but if you have already established a record within your field of study then it can be a very helpful portion of your application. Even if the department does not request it you can use it as an email attachment when first contacting professors you might be interested in working with. Remember it is a great idea to have multiple CVs. One that is extensive, one that is only 1-2 pages, one that is for academia and one that can be used for applying to other jobs. For guidelines on CV creation you should look at examples online. Compare and contrast formats and stylize yours to fit your accomplishments. At the application stage for graduate school you will want to include the following (not necessarily in this order):

- 1) Educational Background
 - academic/research adviser(s) (mentor)
 - senior or masters thesis title (if applicable)
- 2) Short Career Statement of Interest
- 3) Honors and Awards
- 4) Coursework that is relevant to #2
- 5) Skills (computational and field) relevant #2
- 6) Publications and Presentations (abstracts you were included on)
- 7) Relevant work experience (Teaching assistant, work study in a lab, etc.)

Letter of Interest

For each application you will either write a statement of interest or answer a series of question about your academic interests and background. It will be especially good if you can articulate the science questions that you are interested in working on as a graduate student, what aspects of geosciences motivate you, and what about the department is in common with your ethos and interests. Make sure to answer the specific questions asked by the department, but if it is free form here is an organizational outline:

An effective letter should be about 2 pages with space and a half between the lines. An outline might be: paragraph 1—summary of the letter, including one sentence on your background, one sentence of your perceptions of their great department, and one sentence on the specific program(s) in which you are interested (use keywords such as “geomorphology,” “tectonics,” “hydrogeology,” “planetary geology,” etc., ending with the statement that thus you are enthusiastic about joining their program. Paragraph(s) 2 (and 3)—brief introduction to yourself highlighting your academic or other notable achievements with relevance to your application. End with a set of comments about why you want the degree for which you are applying. Paragraph 4—having done some research and made some contacts at that institution, talk about how your interests match well with the faculty and research programs in the department in which you are interested.

Letters of Recommendation (3-4)

Your letters of recommendation need to be excellent. This is because a mediocre letter of recommendation implies that you don't really stand out as a candidate as viewed by someone in a similar position as those you are applying to work with. Letter writers should know about this. Your job as a student is to establish some mentoring relationships with faculty of your department. They should be more than happy to help

you get into a graduate school. While it is probably not that common to form strong relationships with 3-4 faculty as an undergraduate; you will need 3-4 letters of recommendation. At least 2 of these people should know you well.

If you are uncertain whether a letter writer will be able to write an excellent letter for you, ask! The particular faculty may decide they don't know you well enough to say anything substantial. Getting an A in one class is not necessarily enough to get someone to write you a letter. However, if you got an A and spent significant time working on a really cool class project then the professor might highly recommend you!

Give your letter writers time to do a good job. While some faculty do everything last minute it is better to let them to decide how last minute they want to do things. So tell them about your applications early. Don't just tell them "I'm going to grad school." Tell them where you are thinking about applying, who you want to work with, and on what topics and why. They will likely give you advice and may suggest someone they know well; a person that will highly value their opinion as a letter writer and perhaps someone that has a cool project to work on. While your mentors are there to help you; remember that they are busy so you may need to gently and regularly remind them of deadlines.

Overall assessment of the application

Many students wonder how their grades or GRE (or TOEFL for non-native English speakers) will be viewed within the entire application package. Every potential advisor and department is different and some may have minimum numerical standards for these scores. But, nearly everyone looks at the application as a whole. Most of the faculty looking at the applications are experienced and have seen many tens to hundreds of such applications and have certain indicators for which they look. Many geology applicants for example will have very good grades in their major, but only good grades in the ancillary science and math subjects. It is often those who have very good grades in all subjects who are a nose ahead in the decision process. The reviewers look carefully at the letters of recommendation, and take into consideration the writer. Is this person a fellow professor? Then, the reviewer expects to see assessment of classroom achievement, but also examples of independent research, commentary on personality in the sense of compatibility with colleagues, etc. Letters from industry professionals or those outside of the earth sciences can be good, but almost always carry less weight because of the uncertainty in assessment of the commentary by the faculty reviewing such letters. The one thing that you can control well is the content and presentation of the Letter of Interest. It should be interesting, have helpful detail with anecdotes, be not too long or too short, and should be very well proofread.

After you have applied

Applications are typically due in early to mid January, but some are due earlier than this. If you are one of a department's top applicants they will notify you by the end of February and may invite you for a visitation weekend with the rest of their top applicants. These visitation weekends are often Thursday-Saturday in late February or March. In addition to notification of acceptance you will be offered a financial package that typically includes tuition waivers, health insurance, and teaching or research assistantships for 2 years if you are seeking a Masters or 3-5 if you seek a Ph.D. Sometimes departments have other incentives such as fellowships for their best

applicant(s). There are also external graduate fellowships that you may be eligible for. These can help you progress more rapidly, so be on the look out for them!

You are not required to respond to an offer of admission/financial package until April 15th <http://www.cgsnet.org/Default.aspx?tabid=201> because graduate schools have an agreement about this date. However after April 15th your decision should be thought of as binding. However, it is beneficial to other applicants and the department who has offered you admission that you notify them early if you are clearly not going to attend. That way the school can send out an acceptance to another applicant. Thus some schools will likely notify you later than others. Don't feel slighted if you are not accepted in February. You should choose the program that best fits your needs, not necessarily the one that needs you the most. However, if you are accepted later it becomes less likely that you will be offered a free trip to visit the department, but you may be able to work with a potential adviser or graduate coordinator to help fund your travel expenses for a visit.

Visiting a department can be very important. It is the easiest way to get a sense of their academic culture. When visiting, talk to the graduate students about their experiences, meet with potential advisers, and get a sense of the area where you will live for 2-6 years. This will be a significant and fun portion of your life, but it will also be stressful. So it is important to feel comfortable with the location and the people with whom you will be working. One piece of caution is not to go into a visit with particular prejudices or expectations. You may find that academic stereotypes based upon department reputation, size, or other factors are not true. It is important to ask your adviser how they mentor students. Do they provide much oversight? Do they have 9 other students? Are interdisciplinary projects encouraged? Use the visit to figure out as much as you can! Keep your options open if possible. More than one potential advisor may be interested in your application at a given place. Let both know that you appreciate their interest and that you would like to wait to decide until after you have been at the school for a semester and see if that will be ok. Some students are thus admitted to work in research groups, rather than to individual faculty members, with the idea that you will decide on the specific advisor later.

After visiting you may still be having a hard time making a decision. You may want to go back to your mentor(s) and talk through it a bit. Another strategy is to ask your potential advisors more about research projects and begin to envision what the work will be like. Think about the fit of research, quality of life, reputation of department, your career goals, location, and any other factors you value. Ask also about the measures of progress for the degrees: how many exams? Orals, university, and defense-related assessment can vary. What is the minimum GPA? How are grievances between students and faculty managed?

Once you accept you should begin thinking about transitioning to the graduate student lifestyle. Should you move early in the summer and begin research right away, your adviser may have funding? Maybe it is better to spend that time with friends and family if you are moving far away. Either way now you really need to start building those relationships with the faculty at your new school. So keep them informed and prepare for the adventure ahead!