# CAL POLY POMONA GEOLOGY MASTER'S PROGRAM REVIEW – MAY 2, 2016

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## INTRODUCTION

The Geology Master's program is finishing its fourth year within the Geological Sciences Department of the College of Science. The MS degree in Geology comprises 45 quarter units, including a 9-unit thesis sequence as the culminating experience.

Originally approved in 2010 as a traditional state-funded graduate degree, the program was initiated in fall 2012 under the condition that it operates as a self-supported entity. The MS program appears to us to be successful in terms of multiple metrics including student demand, enrollment, diversity, advising and mentoring, unique faculty and research opportunities, external funding, professional growth of students, degrees awarded, placement of graduates, and helping to fulfill the mission of the university. However, the program has incurred deficits since its inception that required significant subsidy by the Dean of the College of Science. This deficit occurs despite charging higher tuition for graduate students enrolled in 500- and 600-level courses. The extra cost has an unintended consequence of inhibiting growth and restricting access to program for highly qualified, underrepresented students with limited finances. This is in conflict with two of the most important aspirations of the University: accessibility and inclusion for its student body. A primary focus of the review is to offers possible solutions to the financial issues encountered as a result of the implementation of the implementation of the geology Master's program.

## PRIMARY OBSERVATIONS AND RECOMMENDATIONS

In addition to the consideration of the overarching financial issues this report, derived from interviews and meetings during the one-day review visit, touches upon other features relevant to the status of the program and its financial condition. The additional points of discussion stem from: 1) questions posed by administrators; 2) interviews with faculty and students, and 3) observations that we made during our visit.

During our initial meeting of the day, Dr. Daniel Lewis, Interim Associate Vice President of Academic Quality and Assessment asked the following. Below we include answers to these questions based on observations from our visit. Other thoughts and reflections to what we learned follow the answers to five questions posed by Dr. Lewis.

1. ***How does the geology master's program compare with a) those within Cal Poly as well as b) comparable programs of neighboring universities and those of the Cal State system****?*

   The MS in Geology at CPP compares quite favorably with neighboring universities (Fullerton, Northridge, San Bernardino, Long Beach), and seems more vibrant than the MSc programs at CSU Los Angeles and CSU San Bernardino.

   Similarities with neighboring universities include: a) total numbers of students and b) placement in professional careers and PhD programs.

   Differences include a) seismology and hydrogeology emphases (a strength) and b) large numbers of students per faculty member (a concern). But perhaps the greatest difference is the fact that this program is not fully state-supported.

   Geoscience departments at neighboring universities (Fullerton, Long Beach, Northridge) are fully state supported because they teach a higher percentage of FTES in GE-level courses. We would argue that a university such as CPP with a high proportion of tech- and engineering-oriented students should consider requiring many, if not all CPP undergraduates to take an 'earth-literacy' science class. Such a class could be Planet Earth: A Citizen's Guide (CGS 1010), a course that has been recently approved as a new course and part of CPP's semester conversion plan. Increasing FTES in this way would allow for a small, but vibrant MSc geoscience grad program to thrive at CPP and would release pressure on CPP faculty to advise unusually large numbers of grad students per faculty member (see question #2).

   We do not know the number of FTES that the department would need to generate, but suspect that this can be achieved. For example, the fact that CSU Fullerton requires all engineering majors on its campus to take an Introductory Geology course, and thus enrolls ~2400 students per year (=240 FTES/yr), affording their department the luxury of offering an MSc program that enrolls ~10 grad students per year. CPP's Dean Jersky pointed out that a nearby teaching theater-style classroom could accommodate 230 students. Utilizing this large classroom to teach the new course (CGS 1010), in conjunction with other popular classes the enrollments of which are constrained by the size of available classrooms, has the potential to increase credit production to the level that it offsets the current grad-program deficits.

**RECOMMENDATION #1**. We urge the department, college, and university to find a way to make this a fully state-supported program.

2. ***What is and has been the effect of the new graduate program upon the undergraduate program of the Department?***

   We cannot emphasize strongly enough that CPP GS faculty have done an amazing job to establish this graduate program and devote a great deal of their time and resources to its success. Some faculty members have upwards of 10 grad students and that seems excessive to us and possibly not sustainable. We share a concern that this has impacted the undergraduate program, but are not able to evaluate that aspect. The two new tenure-line hires in the department since 2014 (Murray and van Buer) will no doubt have a positive effect on both grad and undergrad programs and will help to distribute the teaching load.

   **RECOMMENDATION #2**. Consider the possibility that a 'fewer grad students-is-better' policy that can strengthen the quality of both the graduate and undergraduate program.

3. ***What faculty needs emanate from implementation of the graduate program?***

   Space. Support. Time demand.

   Space seems to be at a premium in the department both for graduate students and faculty. Grad students are currently using space 'on loan' from kinesiology. Designating a permanent geology space for grad students should be a priority.

   Dean Jersky has been very supportive of the program and is to be commended for this. However it is simply not sustainable for the college to subsidize the graduate program because it does not generate enough money to pay for itself.

   The time demand on faculty to teach, advise both grad and undergrad students, serve on committees, write and submit grant proposals, and publish research must feel overwhelming and does not seem sustainable to us. Trying to run a self-support program must only add to this problem by encouraging faculty members in the department to take on as many grad students as possible. Ultimately this may sacrifice quality for quantity and impact other important faculty endeavors (like research and teaching). We urge the department and university to consider the benefits of a 'less is more' approach with regards to the geology MSc program.

We heard from Provost Alva that some space is 'underutilized' on campus. This surprised both of us because our impression from our visit is that the Geological Sciences Department efficiently, if not over-utilizes its space (it certainly makes the most of what is currently has), and practically is bursting at the seams and faces significant space challenges if it were to add faculty and research capabilities. Perhaps some form of college- or university-wide space survey can be conducted and then used to reallocate space based on need. We suspect this would confirm what we observed and heard during our visit that the department needs more space.

**RECOMMENDATION #3**. Provide more space to the department, both communal work space for graduate and undergraduate students, and for new faculty and research space.

4. ***What metrics should be employed in order to assess requests to add faculty?***

Graduate student demand. The fact that 4 tenure-line faculty members have established an active population of 15+ MSc students is VERY impressive and demonstrates that a healthy demand exists for this program. The two new tenure-line hires since fall 2014 (Murray and van Buer) certainly will help to increase those numbers once these new faculty members begin to establish their research programs.

But having a program with 15-25 active graduate students, necessary to offer graduate-level classes in a self-support system, is a tall order for a 6-member faculty department to sustain. Thus one compelling metric is the request to add faculty and distribute the graduate student load to a more reasonable level. This can increase the variety of course offerings (both for grads and undergrads).

A faculty that consists of 7-10 geology faculty at neighboring universities (Fullerton, Long Beach, Northridge) works pretty well to hold steady grad student populations of 20-30 with ~3 grad students per faculty member. Serving as a research adviser for 3 graduate students at a time, on average, is more in line our personal experience and the experience of colleagues at our institutions.

**RECOMMENDATION #4.** Hire at least two new geoscience faculty members in the next 2-5 yrs. We both agree that two hires in the specialties cited in the in the self study would strengthen the department in both uniqueness and quality (see #6 below).

5. ***Is the capstone of the master's program that entails writing a thesis, which generally is an arduous and time-consuming process – that involves much one-on-one interaction between advisor and student – worthy of the effort and expense, especially in light of the common need for extensive editing and revising stemming from poor basic writing skills?***

   Most emphatically, YES! To not require a written geoscience MSc thesis would place CPP graduates at a serious disadvantage when competing for PhD programs and/or professional careers. Both potential PhD advisers and managers in geoscience professions such as environmental consulting, petroleum, or government agencies prefer to accept or hire newly minted MSc graduates that have demonstrated that they can complete a publication-quality or project-report style written thesis.

   Helping an MSc student write a quality thesis requires a great deal of time and effort by the research adviser, hence the statement above about focusing on 'less is more', and quality over quantity of grad students.

   One thing for the department to consider is to incorporate more writing requirements into the existing curriculum to try and improve writing skills prior to the time students start to write up their thesis.

   **RECOMMENDATION #5**. Insist upon keeping the requirement to complete a written thesis for MSc candidates in geoscience.

6. ***Is it possible to identify qualities of the Cal Poly program that fulfil the aspirations of the University and further demonstrate uniqueness and quality?***

   The department has well positioned itself to serve both 'traditional' and 'non-traditional' geoscience Master's candidates. Drs. Marshall, Murray, Nourse, and van Buer cover instruction and research in more classical areas of geological science; those areas of geoscience that form the core of most undergraduate geology curricula nation wide, and attract students that are still in high demand by PhD programs and public and private sector employers. Professors Osborn, Polet, and the two potential new hires described in the self study cover instruction and research in increasingly important 21$^{st}$-century areas of geoscience (seismology, hydrogeology, climate change, and hazard assessment).

   An 8-member department with this blend of faculty members would indeed distinguish itself in the region as one that can take full advantage of its geographical

location in terms of geology, societal impact, cultural diversity, and socioeconomic settings. Such a program would produce graduates with strong backgrounds in understanding the bedrock geology of San Gabriel Mountains and southern California in general, groundwater resource management of southern California, risk assessment and hazard mitigation (earthquake, fire, flood, landslide, infrastructure), and changing climate. Its graduates certainly would be well positioned to gain acceptance into national and international PhD programs and land jobs with both private and public sector professional organizations (geotechnical and engineering geology firms), especially those in southern CA; and public sector organizations like the CA Geological Survey, the USGS, LA County Public Works, Caltrans, to name a few).

**RECOMMENDATION #6.** Support this program! The Reviewers think that this program has only begun to realize its potential. The quality of the students that CPP attracts is impressive. This fact in combination with the exceptional CGS faculty and geologically unique setting can, with time, transform this grad program into one of the top geological sciences grad programs in the CSU system.

**OTHER OBSERVATIONS AND RECOMMENDATIONS**

Meetings with department faculty, graduate and undergraduate students, Dr. Brian Jersky, Dean, College of Science, and Dr. Sylvia Alva, Provost of the University and Dr. Lewis also included discussions about the following topics.

1) Faculty workload and 2) graduate program curriculum and related uniqueness,

The faculty workload is very high (Self Study Report, Table 5). A significant part of the workload is attributable to the number of graduate students (>30), which is driven in part by the need to keep graduate enrollment high in order to generate revenue for self support and FTES credits. Assuming that the transfer of production of credits to the large general education classes is successful, the number of graduate students may be reduced by about 30% so that the average per faculty member is 3-4 rather than about 6. Provost Alva pointed out that streamlining the number of graduate curriculum tracks from three “niches” (Self Study Report, Table 1b) to two would have a potential double benefit of a) reducing the number of courses offered, and b) focusing the Cal Poly graduate geology program upon Water Resources and Geophysics/Earth Exploration, each of which relates to the unique geographic setting of the University, at the foot of the San Gabriel Mountains in semi-arid southern California.

3) 5-year blended program,

The reviewers consider the implementation of the 5-year "blended" BSc/MSc program as an option for the exceptional student who completes a number of graduate classes as part of the undergraduate program. In all likelihood it still requires a full year, including summer, to complete additional courses, conduct of graduate research, and generation of the thesis. The Reviewers believe that the written thesis is a crucial part of geological training in that it is not a report of an experiment or completion of a project. Rather the thesis represents presentation of creative scientific research. The process of recognizing, characterizing, collating, presenting and discussing important data and observations is common to many geological activities and the thesis is fundamental to development of a highly useful if not essential skill set.

4) More on space issues.

The Reviewers noted that: a) faculty are cramped in small offices, b) student spaces are too small for the existing cohorts to work together and otherwise interact efficaciously, c) there are no spaces designated for TA's to grade and/or meet with students, d) research lab space is almost non-existent, and e) no space is available for any additional students or faculty. Provost Alva mentioned that a space assessment survey could help to address this problem. We agree and support this idea.

5) Tuition waivers.

Lastly, the Reviewers urge that CPP provide teaching and research assistants with a tuition waiver program as is common in most CSU MSc graduate programs. Otherwise, graduate students are essentially returning their modest earnings from teaching assignments to the university when they pay their tuition. Tuition waivers to the top 2-4 grad applicants per yr in geological sciences would a) attract applicants with strong credentials and thereby enhance the quality of the grad student applicant pool and b) provide incentive to grad students to pursue their degrees without working full time and focus more time on completing their degrees, thus streamlining the time to degree and improving the quality of their theses projects.

**SUMMARY**

The Reviewers believe that nascent graduate geology program at Cal Poly Pomona provides multiple benefits to the Department. Among the benefits are: 1) attraction and recruitment of very highly qualified faculty members who work exceptionally hard, 2) development of and emphasis upon research niches having to do especially with water, geophysics, and earth exploration, each of which is highly relevant to southern California needs, and 3) successful formation of a talented, diverse, cohort of graduate students.

During most of our meetings strong emphasis was placed upon the necessity to address the financial shortfalls associated with conducting the geology master's program as currently supported. It was noted that a successful model to support the graduate program would require increasing the equivalent of several if not many tens of full-time-equivalent students (FTES). Growth in this manner cannot be achieved by adding more graduate students. Rather, our best advice is to try and achieve this growth via offering some form of a blockbuster general education (GE) course. Although competition for GE courses on campus is keen, we are impressed by the course description and content of CGS 1010 and believe that the course has the potential to be very popular with tech- and environmentally-savvy students at CPP, particularly those students with majors in the colleges of Agriculture, Environmental Design, Engineering, and Science (the fastest growing college at CPP).

Finally, we think that the MSc in geological sciences is worthy of full state-support and hope that this can be achieved through further negotiations among the department, college, and university in light of the growth of FTES credits.