



December 8, 2020

Dr. Elisabeth Wade  
School of Science & Technology Dean  
Sonoma State University

Dear Dean Wade,

My external review of the Geology Department is attached. I enjoyed the visit and appreciated the candid observations of those I met with. Please feel free to get in touch if you have any questions regarding this report.

Best wishes,

A handwritten signature in black ink, appearing to read "Alan D. Chapman".

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cc. Dr. Deborah Roberts, Associate Vice President for Faculty Affairs  
Dr. Karen Moranski, Senior Associate Vice President for Academic Programs  
Dr. Matty Mookerjee, Geology Department Chair

**Geology Department Curricular Review  
Sonoma State University  
November 2020**

**Reviewer:** Dr. Alan Chapman, Associate Professor of Geology, Macalester College

**1.     *Background***

I was asked to conduct an external review of the Geology Department at Sonoma State University. The original on-site review was planned for the 2020 Spring semester. However, the COVID-19 pandemic delayed the review to Fall, 2020 and all planned meetings were migrated to the virtual realm. The virtual nature of my visit precluded visiting physical spaces though I am confident that the detailed descriptions of these spaces provided by the Geology Department are adequate for this review.

The last review of the Geology Department occurred in April, 2014. After reviewing the findings of this earlier review and the department's 2019-2020 Five-Year Review Self-Study Document, I remotely met with Sonoma State University administrators and Geology Department faculty, staff, and students on 5 November 2020. In order, I met with the Associate Vice President for Faculty Affairs (Deborah Roberts), four Geology Department students, the Dean of Science and Technology (Elisabeth Wade), I gave a research seminar unrelated to this review, and met with all full-time faculty and staff from the Geology Department (Owen Anfinson, Marissa Mnich, Matty Mookerjee, and Philip Mooney). Because of the department's informative and comprehensive self-study report and candid conversations with all parties, I emerged with a number of clear impressions about the Geology Department at SSU. In this report, I summarize the findings and recommendations of the 2014 review and provide key observations and recommendations resulting from my visit.

**2.     *Synopsis of Most Recent (2014) Review***

The Geology Department was last reviewed by Dr. Russell Shapiro of California State University, Chico in 2014. That review underscored the Geology Department's strengths in field-based instruction, student-faculty research opportunities, and computational geology. As noted in section 5, the department continues to excel in these areas. Perceived weaknesses noted in the 2014 review (e.g., a lack of elective course offerings, a high-ratio of majors to full-time faculty [85:3], and a high-number of degree and certification programs for the size of the department) all stem from a need to hire additional tenure-track faculty. Despite making several hires over the last six years, an equal number of retirements and departures have occurred, and this fundamental need remains to this day.

**3.     *Observations***

The Geology Department is a vital part of the Sonoma State community, offering students a range of courses, research, and experiential learning opportunities (field-based experiences in particular) during the academic year. Student and faculty engagement in coursework,

departmental and class field trips, and research is global in scope and consistent with the mission of the university.

Geology has healthy enrollments in GE and major courses. In the five years prior to the pandemic, which diminished the number of majors by ~20, the number of declared majors hovered around 80. The department is conscious of the adverse, University-scale, effects that the pandemic has had on enrollments in 2020 and is considering rebranding the B.A. option to a more inclusive “Earth and Environmental Science” degree to combat this issue.

Geology majors are clearly satisfied with their coursework and the department culture, and get jobs in industry and enroll in graduate programs upon graduating. Students frequently cite field experiences in exit surveys and anecdotes as key to their decision to major and to cultivating a deep understanding of geological concepts. Geology faculty and staff and Drs. Roberts and Wade all share this view. Field trip funding has varied in recent history, rendering geology faculty and staff unable to adequately plan their field experiences. This issue is explored in more detail below in section 6b.

The department employs three full-time faculty, one part-time faculty in the Faculty Early Retirement Program, and a full-time lecturer. All full-time faculty and staff are involved in, or are currently ramping up, committee work on campus, outreach to the community, and in significant service and scholarship to the larger educational and research communities.

Professors Anfinson and Mookerjee have active research programs in which they involve students. Indeed, much of the post-graduation success that Geology majors enjoy is likely due to the research experiences provided by these faculty members. Presently there are ~10 students (of a total of ~60 majors) working on research projects under professors Anfinson and Mookerjee. The degree of faculty-student research is expected to increase as their new hire, professor Mnich, ramps up their research program. Faculty and student researchers are active in presenting research results at disciplinary meetings and professional conferences. Faculty research is externally and internally supported and is regularly published in top scientific journals.

Due to the backgrounds of Geology Department faculty, student research projects focus on issues of academic, rather than industry, interest. Similarly, student advising currently comes from an academic perspective and students are missing, and are hungry for, advice and experiences from an industry expert. Furthermore, many Geology Department graduates ultimately find employment in industry (most notably through the North Coast Regional Water Quality Control Board) and would benefit from the presence of an industry liaison embedded in the department. For these reasons, I find the Department’s request for a tenure track hydrology position to be logical. This issue is explored in more detail in section 6a.

It should be noted that the Department hired a hydrologist (Dr. Robin Glas) in 2018, who left SSU within two years. Similarly, a petrologist (Dr. Laura Waters) was hired in 2017 and departed within two years. The SSU Geology Department thus has a faculty retention issue, which will be explored in more detail in section 6a.

Space and facilities are generally adequate, and the department has added value to its shared lab spaces and facilities by showcasing student/faculty research via student-authored research posters adorning the walls. Geology houses an impressive array of equipment for teaching and research, including all necessary equipment for preparing rock samples for optical and scanning electron microscope (SEM) analysis. All necessary equipment is available for mineral separation purposes (the Department houses a magnetic separator, high-density liquids, and a rock crusher) with the notable exception of a rock pulverizer (an ~\$8,000 mill that turns rock chips into sand). The department will add a new state-of-the-art SEM, secured through NSF funding, to its arsenal in 2021. The new SEM will enable cutting-edge research and teaching for all faculty in the Geology Department plus several faculty in Biology, Physics & Astronomy, Engineering Science, Anthropology, and GEP (Geography, Environment, and Planning) departments. The new SEM and existing equipment promises to be an impressive facility, especially for a primarily undergraduate institution.

#### **4. *Geology and Earth Science Majors***

The Geology Department offers two degrees: a B.A in Earth Science and a B.S. in Geology; the key difference between the degrees lies in a higher proportion of required field courses in the latter. Students in each program describe all of the faculty and staff in the department as engaging and dedicated to their undergraduate education. This is particularly noteworthy given the current pandemic; the faculty appear to have transitioned their effective in-person teaching talent to the virtual realm. Students told me about their participation in many excellent research opportunities. Despite their current inability to be physically together, the majors appear to be a cohesive group of students, who are ambitious about their futures in graduate school, industry, and other endeavors. Students have a dedicated common space in a rock storage room and a student computer lab for majors. However, students share a clear concern for a lack of industry connections that existing faculty are capable of providing them. This concern will be addressed in more detail in section 6a.

#### **5. *Curricular Highlights***

The geology curriculum includes a significant component of experiential learning through field experiences, sample preparatory and analytical experiences, and experience with software used widely by geoscientists. These activities are instrumental in attracting majors and preparing them for graduate school or careers in the STEM fields. This section highlights four activities that lead to unique strengths among SSU Geology graduates.

First, many courses, including some large-enrollment GE courses (e.g., GEOL 102 - Our Dynamic Earth: Introduction to Geology), include field trips. Several courses for Geology B.S. majors include field components taken in conjunction with lecture- and lab-based components (e.g., GEOL 307/308, GEOL 311/312, GEOL 313/314, and GEOL 317/318). In addition, the B.S. major requires a 10-day field-based synthesis of concepts explored in the core of the curriculum (GEOL 420), and a traditional five-week geology field camp (GEOL 427; typically taken outside of SSU). As a result, SSU Geology majors emerge with significantly more experience in the field than most graduates of undergraduate geology programs in the U.S. SSU Geology believes that “the heart of geology is in the field,” its graduates and current students

echo this sentiment, employers and graduate programs benefit greatly from workers with field skills, and for these reasons the field focus in the Geology Department at SSU should be considered a major strength to retain. Instructor Mooney is responsible for participating in, and handling logistics involved in planning, most field trips. The time involved in this juggling act is immense and Mr. Mooney clearly excels at these tasks.

Second, among the first courses students encounter in the major sequence is GEOL 309 – Computer Application in Geology, regularly (i.e., in non-pandemic times) taught in the computer lab. This course is fairly unique among geology programs and its installment has increased the level of rigor in the department. The consensus among instructors and students alike is that skills acquired during this course (e.g., GIS, drafting, and data manipulation software) are very useful after graduation.

Third, a seminar course was added to the curriculum in Fall 2020. Speakers recruited to give lectures as part of this series include a mix of academics and industry professionals mainly from the Bay Area and are occasionally brought in from across the country. This new series is valuable in many regards. It exposes students, faculty, and staff alike to outside perspectives; perhaps more importantly it provides a key source of cross-pollination between students and individuals from the private sector, which is otherwise largely missing.

Finally, a number of research projects and course lecture and lab meetings involve student use of the existing Scanning Electron Microscope (SEM; which will no doubt increase with the installment of the new SEM in 2021), mineral separation facilities, thin section preparation equipment, and analog modeling facilities. As noted above, the array of facilities available to SSU Geology majors and researchers is impressive for a primarily undergraduate institution and a strength to retain. The faculty and students are content with existing lab spaces and facilities, though adding a rock pulverizer would fill an obvious gap in the mineral separation lab.

While Geology majors are not required to engage in collaborative research with faculty, students noted that opportunities are regularly provided by Professors Anfinson and Mookerjee (Professor Mních also plans to provide research experiences to interested students as their research program ramps up). Hence, SSU faculty are clearly dedicated to providing undergraduate research experiences to all interested majors.

## **6. *Issues and Potential Solutions***

The mission of the Geology Department is “To engage students through lecture-, field- and laboratory-based courses, and to train them to identify and interpret the materials, structures, processes and history of the Earth. To provide our graduates with the skills needed to pursue careers in education, government, research, and industry, particularly within California. To provide our faculty with opportunities to create and apply knowledge in the earth sciences and to communicate scientific understanding to students, peers, and the communities we serve.” The goals outlined in this statement overlap considerably with the mission of SSU, particularly its desire to prepare students for a lifetime of learning, to appreciate intellectual achievements, to be leaders in society, to pursue fulfilling careers, and to positively affect the planet and its inhabitants’ well-being.

To that end, above sections highlight the many strengths of SSU's Geology Department but also raise a number of issues that hinder its ability to accomplish its mission, and by extension that of SSU.

**a.      *Tenure-Track Faculty and Staff***

As of November, 2020, the Geology Department at SSU consists of three full-time tenure-track faculty (Owen Anfinson, Marissa Mnich, Matty Mookerjee), one full-time educational support technician (Philip Mooney) and two main lecturers. Since 2014, enrollment in GE and Geology major courses remains high while three lecturers were lost and the number of tenure-track faculty has remained at three. As a result, the Geology Department is stretched thin. Symptoms of this issue include:

- i)      An inability to offer a diverse array of upper-level electives
- ii)     A lack of opportunities for students to gain the perspectives of industry professionals
- iii)    A limited number of research opportunities available among faculty and related restricted ability of faculty to cater to the specific research interests of students.
- iv)     Curricular challenges faced when fellow faculty cannot teach due to injury, illness, or sabbatical.

With these observations in mind, at least one tenure-track faculty member, ideally with ties to industry, should be hired as soon as possible. In an effort to reflect SSU's diverse student body, the Geology Department has made every effort to hire faculty from diverse backgrounds in the past six years. However, compensation and spousal hire programs were not competitive enough for these highly sought-after individuals and they departed. In light of recent faculty attrition, incentives encouraging retention of faculty must be explored. Otherwise, this retention problem will persist and will continue to disproportionately affect underrepresented faculty. Diversity tops SSU's list of core values in its 2025 strategic plan. To follow-through on this value, faculty retention initiatives should focus on squaring compensation with the cost of living and on solving "two-body" problems.

**b.      *Field trip funding***

The Geology Department at SSU has a strong national reputation for their field-based program. Historically, funding for field trips was provided through the Provost's office. This changed in 2017, with the most recent (i.e., non-interim) Provost arguing that funding for field trips should be provided through the Dean's office. The department has since scrambled to come up with the necessary funds, proposing solutions such as raising course fees, an idea discussed with the Dean and Student Services that ultimately did not gain the required traction. Currently, funding for field experiences is cobbled together from a variety of sources; while funding has been consistent, it is often provided shortly prior to or after trips, leading to perennial uncertainty in the Geology Department regarding whether individual trips will be fully funded.

The faculty and staff would like to know their field trip budget further in advance so they can more effectively plan these experiences. To that end, the Geology Department are requesting a

supplement from the Dean, who is open to having this conversation along with the budget manager.

### **c. Facilities**

Geology Department faculty and staff share a lab space for research purposes, a computer lab (containing all hardware and software required for GEOL 309 – “Computer Applications in Geology” and a plotter for printing maps and research posters), a machine shop, a rock storage room (in which majors and minors congregate), preparation facilities for making rock slides and preparing samples for SEM analyses, a wet chemistry space, and a room for analog modeling equipment. Space is available for the incoming SEM and a fourth faculty member, should a hire be made in the near future. Hence, Geology faculty and staff appear to have adequate space, and most necessary equipment for teaching and research.

One notable exception is a rock pulverizer required for mineral separation in Professor Anfinson’s lab. This work requires disaggregating rock and using a variety of magnetic and density techniques to separate various minerals from the rock mass. A pulverizer turns pea-sized rock fragments (the output from rock crushing using a separate piece of equipment) into sand, which is essential for later stages of mineral separation. Rock pulverizers cost ~\$8,000, an awkward amount as this is too little to warrant applying for external funds and too much for a typical department to pay for using available funds.

## **7. Recommendations for the Next Five Years**

Based on the observations above, I make the following recommendations for the next five-year review period:

1) The most critical need is to **bring the department to four full-time tenure-track faculty by adding one position** as soon as the pandemic-related hiring freeze is lifted. Given the department’s existing strengths in traditional academic areas (e.g., structural geology, petrology, sedimentology, and volcanology) and the proportion of SSU Geology graduates who pursue employment in industry, the department should prioritize hiring a geoscientist with strong ties to industry. In light of the importance of water resources in the Bay Area and throughout California, the department would like to add a hydrologist to their roster. An expert in engineering geology, environmental geology, or mineral/petroleum resources would similarly be excellent additions.

It will be challenging to attract and retain a qualified individual from one of these areas due to higher earning potentials and lower workloads in industry compared to the academic realm. Attracting an individual from an underrepresented background in one of these areas, as the department would like to do in an effort to better reflect SSU’s student population, is even more ambitious. I am concerned that if the department was able to make a hire fitting these criteria, they would again lose the new hire due to the high cost of living in the vicinity of SSU and the low salaries of SSU compared the Cal State system. The salary for the position should reflect the unique qualities of the hired individual.

2) For thirty years (1972-2002), Geology was a department of five tenure-track faculty. Since 2002, a wave of retirements and a failure to retain newly hired faculty has diminished this number to three, while enrollments have remained steady. In light of SSU's inability to replace individuals in the Faculty Early Retirement Program, which Professor Matt James will be a part of for the next three years, **I recommend that the department add a fifth tenure-track position in 2023.** Students majoring in geology at SSU are hungry for industry connections; a fifth tenure-track position in an industry-adjacent field would permit such connections.

3) **Continue to offer a curriculum blending the foundations and future of geology.** As noted above, the Geology Department is effective at combining educational touchstones (e.g., field-based courses) with progressive offerings (e.g., Computer Applications in Geology). The department considers the field an extension of the classroom. Students emphasized that they felt immersed in geology while in the field and that being face-to-face with a variety of rocks and landforms facilitated the assimilation of concepts introduced in the classroom. Similarly, students remarked favorably of their experiences in Computer Applications in Geology, noting the direct-applicability of skills acquired in that course to the post-graduate realm.

The Geology Department should strive to maintain or add to their successful curriculum. To do so, **a consistent source of funding for field-based experiences must be identified.** The Geology Department and Dean's office should examine the possibility of a funding supplement from the latter, an option that both parties are open to discussing.

The Geology Department should aim to continue their track record of forward thinking on curricular matters. With this in mind, the idea to change the B.A. option to an "Earth and Environmental Science" degree seems worthwhile. In addition, an obvious area of increasing geoscientific focus is on the intersections between climate change, sustainability, and energy. I see that the Geography, Environment, and Planning Department offers a course called "Global Environmental Systems" (GEP 201) which likely explores these concepts. The Geology Department might consider discussing cross-listing this course with GEP, and in doing so would strengthen collaborations outside the department. Another possibility would be to capitalize on Professor Anfinson's expertise as a drone pilot and add a drone component to Computer Applications in Geology.

The above said, the Geology Department clearly understands the needs of their students and I am confident that they will continue to design a curriculum that leaves its graduates with the skills necessary to pass professional geologist exams and to pursue graduate studies and jobs in industry. It should be noted, however, that the department will be much better equipped to continue evolving the curriculum when a fourth tenure-track faculty member is hired (see recommendation #1) and the cumulative expertise of the department is known.

4) **Add a rock pulverizer to the mineral separation lab.** This piece of equipment is necessary for Professor Anfinson's research, which involves significant mentorship of undergraduate researchers. The Geology Department and Dean's office might consider splitting the costs associated with procuring this equipment.