COLORADO MESA UNIVERSITY

PROGRAM REVIEW 2021

BACHELOR OF SCIENCE DEGREES IN THE GEOSCIENCES PROGRAM

Prepared by

The Geosciences Faculty

Compiled and completed by

Andres Aslan
Professor of Geology

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1. INTRODUCTION AND PROGRAM OVERVIEW

a. Program description

The Geosciences Program—part of the Department of Physical and Environmental Sciences at CMU—offers modern Geology degrees that are comparable to those offered by peer institutions elsewhere in the United States. The program includes majors, minors, and an associate's degree.

The three B.S. degrees within the Geosciences Program are:

- B.S. Geology
- B.S. Environmental Geology
- B.S. Geosciences, Secondary Education

The Geosciences Program also offers three minors:

- Minor in Geology
- Minor in Geographic Information Science and Technology (GIS&T)
- Minor in Watershed Science

An Associate in Science degree is also available in Geosciences. Detailed course requirements for each degree are provided separately.

b. Brief history of program

Prior to 1993, the geology degree was a component of the Bachelor of Science in Physical and Mathematical Sciences, but subsequent to 1993 Geology became part of the Bachelor of Science in Physical Sciences degree. The Environmental Geology degree was implemented in 1995, and the Geosciences Secondary Teaching degree was added in the fall of 1997. The current stand-alone Geosciences major with three concentration options (Geosciences, Environmental Geology, Geosciences Secondary Teaching) was established in 2013.

c. Recommendations from previous review (2012) by the External Reviewer

Recommendation 1: All programs can justify additional tenure-track faculty positions.

Response: The number of T/TT faculty has increased by one, with the addition of a geochemist in 2019. The current T/TT faculty typically teach 12-14 credit hours (12 hours is the minimum required). The addition of a T/TT faculty member has helped the program so that now all upper-division courses are taught by a full-time faculty member with a Ph.D., and all required upper-division courses are offered once each academic year. However, the reduction of full-time Instructors during the review period from 4 to 1, and the school-wide cap on enrollment in online courses to 40 students has resulted in fewer offerings of Geology 100-level courses and an overall reduction in the number of students served by the Geosciences Program at CMU. For instance, a comparison of Spring 2014 and Spring 2021 course offerings shows that Spring 2014 had 20 sections of 100-level courses with a total enrollment capacity of 1102 students whereas Spring 2016 had 16 sections of 100-level

courses with a total enrollment capacity of 668 students. This decrease also reflects faculty teaching re-assignments that had to take place due to Covid as well as an attempt to offer more sections of GEOL 113/113L, which is a gateway course to the Geology major. To attain similar enrollment numbers that we had at the beginning of the review period, additional personnel would be necessary. Note that in 2014 the Geosciences Program full-time equivalent faculty value was 10 whereas in 2021 it is 7.5.

Recommendation 2: Develop and execute an Assessment Plan for each program (concentration or "major")

Response: The Geosciences program has developed and implemented a detailed Assessment Plan.

Recommendation 3: Seek final approval for discrete chemistry, geology, and physics designated major programs.

Response: As described above in Part 1b, the Geoscience Program now offers three Bachelor of Science Degrees in (1) Geology; (2) Environmental Geology; and (3) Secondary Education, Geosciences.

Recommendation 4: Identify strategies to convert students identified as program majors to graduates.

Response: The Geoscience faculty have a strategy to maximize the number of program majors that complete their B.S. degrees. The underlying theme is "get them involved." We have identified seven (7) specific strategies to enhance program majors.

- *Strategy 01: Early mentoring of students in required and elective geoscience courses, especially those struggling with basic concepts;*
- *S02: Involvement of students with ongoing faculty research projects;*
- *S03: Very strong encouragement for participation in CMU's Student Showcase;*
- *S04: Attendance and participation in national and regional meetings of the Geological Society of America;*
- *S05: Encouraging membership in the Geological Society of America and the American Association of Petroleum Geologists;*
- *S06: Providing involvement with professional geologists via the Grand Junction Geological Society's monthly meetings;*
- *S07: Participation in the annual Western Slope Geological Field Conference.*
- *S08: Increase awareness of the program across campus through activities such as the Geo-Day Hike.*

Recommendation 5: Continue to explore additional program opportunities, particularly at the boundary of traditional disciplines, and which rely on existing resources in so far as possible.

Response: As previously mentioned (Recommendation 3), the Geoscience Program now has three specific B.S. degrees. In addition, the Program provides cross-discipline opportunities

for students interested in the Earth System: Associate of Science in Geology (Liberal Arts), a Watershed Science Minor, a minor in Geographic Information Science and Technology, and a Professional Certificate in Geographic Science and Technology. In particular, the GIS courses offered by the Geosciences Program serves many students in biology, environmental science, engineering, business, the social sciences, etc.

Recommendation 6: As the future is contemplated, develop a firm, persuasive version (or "sense of self") for the physical sciences disciplines.

Response: Although not a viable option at present, a greater sense-of-self could be obtained if the Geoscience Program were to become a separate department. This would require a large increase in majors that may follow from full and continued implementation of the seven strategies outlined in Recommendation 4. An additional mechanism to enhance recognition of the Geology Program would be development of a professional master's degree (non-thesis). This was proposed (unsuccessfully) recently, and may be considered again in the future.

Other Recommendations made by the External Reviewer:

Regarding faculty evaluation, broaden the physical sciences "definition" for the scholarly expectation

Response: Most of T/TT faculty are involved in research, publication, and participation in professional conferences. These achievements have provided important recognition from outside CMU and have created important educational opportunities for Geology students. The "teacher-scholar" philosophy has been embraced by the Geosciences for the past 20 years as demonstrated by ongoing faculty research and integrated student participation.

Regarding CMU Catalog descriptions, review course descriptions for CHEM, GEOL, and PHYS to ensure accurate and informative copy.

Response: Changes to the GEOL catalog descriptions have received attention, including the recent addition of both lower and upper level courses (e.g., GEOL 108 Water, People, and Environment; GEOL 443 Field-Based Depositional Systems; GEOL 445 Geospatial Database and Design; and GEOL 455 River Dynamics). In addition, all of the traditional courses are evaluated by the faculty of record to make sure the catalog descriptions correspond to what is being taught.

Regarding laboratory-based instruction, such offerings to accompany lecture course counterparts seem to be at a minimum (perhaps based on staffing space considerations).

Response: The majority of the required and elective Geoscience courses have lecture and laboratory components (e.g., GEOL 111/111L, 112/112L, 113/113L, 301/301L, 331/331L, 340/340L, 402/402L, 404/404L, 411/411L, 415/415L, 443/443L, 444/444L, and 455/455L). Thus, we think we are meeting the standard.

Regarding preservice secondary teaching education; investigate the State of Colorado guidelines for licensure for teaching middle and secondary school "science" subjects (inclusive of biology/life science, chemistry, earth science, and physics).

Response: The curriculum requirements for the Secondary Education, Geoscience (B.S.) meet the stated requirements put forth by the State of Colorado. Should these requirements change, we will modify accordingly.

d. Mission statement and goals

Colorado Mesa University serves the citizens of Colorado, in general, with a specific emphasis on increasing the level of educational attainment of residents in its 14-county region in Western Colorado. Colorado Mesa University's mission, established by the Colorado Legislature, is contained in Colorado Revised Statutes (C.R.S.) 23-53-101:

> *There is hereby established a College at Grand Junction, Colorado, to be known as Colorado Mesa University, which shall be a general baccalaureate and graduate institution with selective admission standards. Colorado Mesa University shall offer liberal arts and sciences, professional and technical degree programs, and a limited number of graduate programs. Colorado Mesa University shall also maintain a community college role and mission, including career and technical education programs. Colorado Mesa University shall receive resident credit for two-year course offerings in its commission-approved service area. Colorado Mesa University shall also serve as a regional education provider.*

The CMU Board of Trustees' has also established an Institutional Mission Statement:

> *Committed to a personal approach, Colorado Mesa University is a dynamic learning environment that offers abundant opportunities for students and the larger community to grow intellectually, professionally, and personally. By celebrating exceptional teaching, academic excellence, scholarly and creative activities, and by encouraging diversity, critical thinking, and social responsibility, CMU advances the common good of Colorado and beyond.*

e. Geosciences Program's support of other majors/minors and general education requirements

The Geosciences Program provides a number of courses that are integral to other disciplines at CMU, but few are required for non-Geosciences degrees. The three minors (Geology, Geographic Information Science and Technology (GIS&T), and Watershed Science) are offered to principally support students in the biological sciences, environmental science, chemistry, physics, mathematics, and the landman concentration in the Business Program. GEOL 111/111L (Physical Geology) or GEOL 113/113L (Field-based Physical Geology), and GEOL 112/112L (Historical Geology) are required for the Biology, Secondary Education degree.

To provide broad and diverse support for CMU's Essential Learning platform, the Geology Program routinely offers 10 courses (either every semester or every other semester):

GEOL 100 (Survey of Earth Science)
GEOL 103 (Weather and Climate)
GEOL 104 (Oceanography)
GEOL 105 (Geology of Colorado)
GEOL 106 (Introduction to Dinosaurs)
GEOL 107 (Natural Hazards and Environmental Geology)
GEOL 108 (Water, People and the Environment)
GEOL 111/111L (Principles of Physical Geology and Lab)
GEOL 112/112L (Principles of Historical Geology and Lab)
GEOL 113/113L (Field-Based Introduction to Physical Geology and Lab)

The total number of students served by these ten courses between 2013 and 2021 (eight years) is 19,667, or 51,095 student credit hours (based on information provided by the CMU Institutional Research Group).

f. Location advantage

CMU is uniquely located in a geologically diverse region that serves as a natural laboratory for the Geosciences program. Geology courses at CMU make extensive use of field trips to places including Colorado National Monument, the Book Cliffs, Grand Mesa, Grand Canyon, Canyonlands, Ouray, and the San Juan Mountains. Collectively, Geology courses include approximately 100 field trips (lab trips and weekend trips) each academic year.

g. Unique characteristics of the program

- **Strong emphasis on field-based learning**. Geology courses involve ~100 field trips each year. Field-based Physical Geology and lab (GEOL 113/113L) is probably one of the only introductory geology courses in the U.S. that is largely taught in the field; each section of this class goes on a 3-hour field trip each week as well as a weekend field trip.

  Geology majors take a 3-credit sophomore-level field course (GEOL 202) as well as the capstone 6-week, 6-credit-hour senior-level summer field course (GEOL 480). Most geology majors in the U.S. take a 6-credit hour field course but few programs require 9 total credit hours of field geology. The Geosciences program also offers a Spring Break 6-day, 1-credit hour upper-division elective field course (GEOL 333) and an upper-division elective 4-credit hour course, Field-based Depositional Systems (GEOL 443/443L) that are also largely taught in the field. Lastly, all upper-division courses in the major also require field trips.

- **Exceptional student-faculty research activity**. Since 2013, 100 students in the Geosciences Program were involved in individual (not group) senior capstone research

projects. Of these, 33 students presented research at regional and national professional geology meetings.

In addition, a combined total of 104 student presentations—several students gave multiple presentations—were given at the annual CMU Student Showcase (among the most of any discipline at CMU), and at the annual April meeting of the Grand Junction Geological Society. One of the students within the reporting period who presented their research at the Grand Junction Geological Society received >$200K in start-up funding from private investors who attended the presentation. This student is currently CEO of his own gold exploration company.

Student research is completed as part of the capstone Senior Seminar (GEOL 490) course, as well as through independent studies, Structured Research, or simply as participation in ongoing faculty research. Students spend 1-3 semesters working on their senior projects.

- **Dynamic faculty.** In addition to teaching a minimum of 12 credit hours each semester, Geosciences faculty supervise research, independent studies, and senior theses. Since 2012, these efforts along with research projects involving other academic institutions and energy companies have resulted in internal and external grants totaling more than $525,000 as well as 33 peer-reviewed publications and 74 published abstracts many of which include student co-authors (undergraduate students were lead authors in some instances).

  Faculty spend a significant amount of time outside of formal class activity in helping students with projects outside of the classroom, in the field, and in the laboratory. Faculty have also made special efforts to involve students in projects involving cutting-edge analytical facilities and collaborations with researchers at U. of Oklahoma, New Mexico Tech, U. of Arizona, Arizona Geological Survey, CU-Boulder, and the U.S. Geological Survey-Denver.

- **Program Activities.** The Geosciences Program organizes two program-wide field trips each year: 1) the Western Slope Field Conference and 2) the Spring semester field trip (now the "Adam Trumbo Memorial Field Trip"). In addition, the Geosciences Program also sponsors an annual "Senior Day" where graduating seniors give presentations on their research and receive awards and recognition for achievements during their careers at CMU.

  The Western Slope Field Conference typically involves participation by geology faculty and students from CMU, Ft Lewis College, Western Colorado Univ., and Adams State Univ. Each institution alternates hosting this weekend-long field conference, and CMU routinely has 30-40 students attend this Colorado-centric community-building event.

  The Trumbo Field Trip is a 1-day field trip in the Spring semester that is open to geology students from all levels. Past trips have included touring: Canyonlands, the

San Rafael Swell, Moab, and the Book Cliffs. These trips are an important way for students and faculty to get to know one another and to learn more about the local geology.

- **Strong emphasis on GIS technology**. A GIS&T minor and professional certificate program are offered, and many of our students have received internships and jobs in the private sector as well as with local and regional government agencies. This program serves many students outside of the Geosciences program (e.g., Biology, Environmental Science, Humanities and Social Sciences, and Business).

- **Collaboration with the Grand Junction Geological Society**. Another unique aspect of the Geosciences program is its close relationship with the Grand Junction Geological Society (GJGS). The monthly GJGS meeting and professional presentations afford excellent opportunities for Geology students to learn about professional career paths and network with professionals. The GJGS also provides scholarships for the summer Field Camp course as well as awards for student research, which is presented annually at the April GJGS meeting.

- **Collaboration with the Museums of Western Colorado**. Dr. Julia McHugh is Curator of Paleontology at the Museum and an Adjunct faculty member in Geosciences at CMU. Through this connection 1-3 students work as summer interns each year at the museum and conduct paleontological research with Dr. McHugh.

- **Dynamic geology club**. The student chapter of the American Association of Petroleum Geologists (AAPG) is active and sponsors talks, field trips, and a variety of fundraising activities.

- **Forrest Nelson Endowment**. The Geosciences Program received a significant donation (currently ~$700K) from Mr. Forrest Nelson in 2018. This donation produces $15-25K in interest each year, the majority of which is used for Geology student scholarships.

h. Program diversity and first-generation & under-represented students

Program diversity: The full-time Geosciences Program faculty (n = 7 as of Fall 2021) includes two women faculty, one Hispanic faculty member, and one faculty member that is hearing impaired. Two of the faculty were first-generation undergraduate students. Through the faculty composition, students are exposed to a variety of viewpoints and approaches regarding the pursuit of educational goals and professional careers. The Program also has several program-wide field trips (one per semester) that allows Geology students, regardless of class standing, to interact among themselves, which helps promote awareness and cooperation among the Geology student body as a whole. Lab assignments and field trips always involve project teamwork, which further promotes collegiality and cooperation among students of varying backgrounds. The outstanding female geology students are recognized annually through the Association of Women Geoscientists' luncheon.

First-generation and under-represented students: The Geosciences Program has served a significant number of first-generation students during the reporting period. No quantitative data exists for this statement, but because of the large number of Essential Learning courses offered in the Geosciences (n = 10), our faculty have interacted with many of the first-generation students that make up a significant portion of CMU's student population. Geoscience students similarly include numerous under-represented students. Most of the majors in the Geosciences Program come from family situations with very modest financial resources – the majority of our majors work ~20 hrs/week, including work-study positions within the Geosciences Program. Roughly 20-30% of the Geosciences students are female in a given year, and there are generally a small, but significant number of Hispanic students in the program. Currently the program has one student from Nigeria. The Geosciences Program has sponsored a Geo-Day Hike the past few semesters that is designed, in part, to help first-generation and under-represented students become aware of the Geology curriculum and potential careers in the Earth Sciences.

2. CURRICULUM

a. Description of breadth, depth, and level

In addition to CMU's Essential Learning requirements, the Geology, Environmental Geology and Geosciences Secondary Education B.S. curricula all require foundation courses in math and science and geology core courses. The foundation courses include general chemistry (one semester), physics (one semester), probability and statistics and calculus (one semester each). Students that plan to attend graduate school are advised to take two semesters of chemistry, physics and calculus, and some of these credits count as restricted electives for the major. The core geology courses include four lower-division geology courses: physical and historical geology, field studies, and computer applications. Six upper-division geology classes are also included in the geology core: structural, crystallography and mineralogy, geomorphology, stratigraphy and sedimentation, summer field camp and senior seminar. The latter two courses are capstone experiences for our geology students.

Beyond the Geology core courses, the three degrees diverge. The Geology degree requires petrology and geophysics, while the Environmental Geology degree requires environmental geology, geochemistry and ground water. It should be noted that we are currently re-designing the Environmental Geology curriculum based on the recent hire of a geochemistry faculty member. The Geosciences Secondary Education degree does not require further geology courses, but the students must take 29 hours of additional education courses.

The Geology and Environmental Geology degrees require that students take nine credit hours of classes from a list of restricted electives. The selected electives were designed to allow students to either focus their studies more deeply into an area of interest, or to take additional math, chemistry or physics if they are planning to apply to graduate school.

The structure of the degree programs with foundation courses, core geology courses, and restricted electives provide students with a strong and broad foundation in science and math,

as well as an ability to focus their studies more deeply into a particular area of interest in geology or environmental geology.

b. Program currency

The depth of the Geosciences Program curriculum (as defined by number of class types offered and the frequency of the offerings) is comparable with the curricula of our regional peer institutions (Western Colorado University, Ft. Lewis College, Adams State University). The Geosciences Program continues to offer a 6-week summer Field Camp course, which is a capstone course for geology programs throughout the U.S. The Geosciences curriculum is generally on par with schools across the U.S. that offer a B.S. degree in Geology.

The Geosciences Program has evolved over the reporting period. Courses have been continually updated and expanded as new developments in the Earth Sciences emerge in the literature, and as the job market evolves. For example, the Environmental Geology curriculum is being updated to include stronger emphases on geochemistry, hydrogeology, and drone technology. Likewise, Geology faculty use their research to enhance subject matter that they teach; thus, ensuring that material presented to the students is state-of-the-art and continues to evolve with modern trends.

c. Description of program delivery locations and formats

The Geosciences Program offers the majority (~99%) of its courses on the main CMU campus. Two courses (GEOL 100 and GEOL 111/111L) are offered periodically on the Montrose campus. GEOL 111/111L is also offered through a cooperative agreement between CMU and Grand Junction High School. This particular course at the high school is currently being taught by a former CMU Geology student.

As stated previously, Geology courses emphasize field-based learning. Courses delivered on the main campus use a lecture format, usually amplified by digital presentations (e.g., PowerPoint). Computer-oriented courses and labs use appropriate software (e.g., ArcGIS Pro, Petra, GoogleEarth). GEOL 100, GEOL 104, GEOL 105, and GEOL 107 (Essential Learning courses) are also offered online most semesters.

3. ANALYSIS OF STUDENT DEMAND AND SUCCESS

a. Enrollment by major, concentration(s) and minors

Seven enrollment categories are included in the data from CMU's Institutional Research Group (**Table 1**):

- Professional Certificate in Geographic Information Science and Technology
- Assoc. of Science (Liberal Arts Geology)
- Geology B.S. (Provisional)
- Geosciences/Geology-Geology B.S.

- Geosciences/Geology-Environmental Geology B.S.
- Geosciences/Geology-Secondary Education B.S.
- Pre-Teacher Ed/Teacher Certification B.S.

Currently there are 84 students working towards a Geology-related degree and of these, 68 are B.S. degree candidates (**Table 1**). For the reporting period (2013-2021), the total number of B.S. majors declined from 104 in 2013-2014 to 68 in 2020-2021. The decline in B.S. majors over the reporting period has been primarily in the Geology degree, but the number of students pursing the Environmental Geology degree is increasing. The total number of students pursuing geosciences credentials, including all degrees and certificates, also declined from 138 to 84 over the reporting period (**Table 1).** The most popular degree is Geology, followed closely by the Environmental Geology degree. Few students pursue the Secondary Education degree.

Table 1. Summary of Geosciences Majors by Degree Program for AY14-21.

Degree	Code	Major	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Prof Cert.	1770	**Geographic Info Science**	2	7	7	8	7	3	5	2
A.S.	2431	**Liberal Arts – Geology**	28	27	28	24	16	16	14	14
	2952	**Geology Prov Bacc**	4	3	2			3	3	
B.S.	3460 3472	**Geology**	79	73	77	68	55	61	49	38
B.S.	3462 3473	**Env. Geology**	21	11	12	15	15	18	23	27
B.S.	3401 3461 3474 3475	**Geosciences Secondary Ed.**	3	0	2	1	4	1	3	3
		Total B.S. Majors	104	84	91	84	74	80	75	68
		Total A.S., B.S., and Certificate Majors	138	121	128	116	97	102	97	84

b. Enrollment and student credit hours by student level

Table 2 summarizes 2013-2021 enrollment by student level. Over the eight-year reporting period, an average of 2249 students enrolled in geology courses. Note – this data **DOES NOT** include enrollment data for the GIST program, which is contained within Geosciences. Enrollment has declined ~25% over the reporting period. **Table 2** also summarizes 2013-2021 data for student credit hours by student level. Student credit hours also declined ~25% over the six-year period.

c. Enrollment and student credit hours by course level

Table 2 summarizes 2013-2021 enrollment by course level. 100-level Geosciences courses are by far and away the most popular geology courses at CMU. Using the annual average values, ~84.5% (1892 out of 2238) of CMU students who take a geology course enroll in a 100-level class. Enrollment in 100-, 200-, 300-, and 400-level geology courses has declined over the reporting period. **Table 2** also summarizes 2013-2021 data for student credit hours by course level. On average, the vast majority (~87%) of student credit hours generated by the Geosciences program are at the 100-level. Over the reporting period, the number of student credit hours generated by all course levels have declined significantly.

Table 2. Summary of Geosciences Enrollment by Credit Hours and Level for AY14-21.

Geosciences	Annual Average 2013 to 2021	2013 - 2014	2020 - 2021	Percent Change 2013-2014 to 2020 - 2021
Enrollment by student level				
Freshman	555	593	506	-15
Sophomore	852	972	686	-29
Junior	366	393	305	-22
Senior	456	554	392	-29
Non-degree	20	11	19	+73
Total	**2249**	**2523**	**1908**	**-24**
Student credit hours by student level				
Freshman	1528	1605	1392	-13
Sophomore	2245	2584	1794	-31
Junior	931	978	775	-21
Senior	1055	1245	907	-27
Non-degree	52	29	51	+76
Total	**5811**	**6441**	**4919**	**-24**
Enrollment by course level				
100	1892	2047	1640	-20
200	53	65	48	-26
300	148	222	82	-63
400	145	191	134	-30
Total	**2238**	**2525**	**1904**	**-25**

Student credit hours by course level				
100	5048	5447	4318	-21
200	160	195	144	-26
300	297	437	172	-61
400	275	368	279	-24
Total	**5780**	**6447**	**4913**	**-24**

d. Analysis of Geosciences enrollment data

One important factor influencing the decline in Geosciences enrollment data has been a significant decrease in the number of full-time Geosciences faculty and a commensurate reduction in course offerings. For example, the number of sections offered in specific 100-level courses decreased significantly during the reporting period, which is consistent with the decrease in the 100-level enrollments and credit hours. From 2013 to 2021 the number of sections (offered annually) of GEOL 100 decreased from 7 to 4, GEOL 105 decreased from 5 to 3, and GEOL 111L (Physical Geology lab) decreased from 12 to 9.

In 2013, there were 9 full-time Geosciences faculty (5 T/TT faculty and 4 full-time Instructors (Jones, Cooley, Hase, Lorhammer)). The retirement and/or resignation of three Instructors and the resignation of Dr. Gigi Richard, left only 6 full-time Geosciences faculty in 2018 (4 T/TT and 2 full-time Instructors (Fenton, Riley)). In 2019, two new TT faculty were hired (Baker, Fenton), but Rex Cole retired in 2020 leaving the Geosciences Program still with 6 full-time faculty (5 T/TT and 1 full-time Instructor (Riley)). In 2021, one new TT faculty member was hired (Tellez); the Geosciences faculty currently consists of 6 T/TT faculty (3 Professors, 1 Assoc. Prof., 2 Asst. Prof.) and 1 full-time Instructor, In summary, the Geosciences program has been short-handed during much of the reporting period due to a loss of full-time Instructors, and the reporting period has involved significant faculty transition. We are optimistic that enrollments will increase as the new TT faculty members establish their presence on campus. The potential impacts of COVID on enrollments is hard to assess but there have been several specific instances where the impact was obvious – GEOL 480 Field Camp was effectively cancelled in the summer of 2020 (2 students enrolled) and GEOL 202 Field Studies was cancelled in Fall 2020.

e. Number of graduates

Over the 8-year reporting period, a total of 93 students graduated with a B.S. in Geosciences, and 120 students graduated with an A.S., B.S. or professional certificate (**Table 3**). The total number of certificates, A.S. degrees, and B.S. degrees in Geology and Environmental Geology awarded were lowest in the 2020-21 COVID year (**Table 3**). Since 2013, the majority of the graduates received Geology degrees.

Table 3. Number of Geosciences Graduates for AY14-21.

Degree	Code	Major	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	Totals
Prof. Cert.	1770	**Geographic Info Science**	0	2	2	4	4	2	1	1	16
A.S.	2431	**Liberal Arts – Geology**	2	3	1	4	0	0	1	0	11
B.S.	3460 3473	**Geology**	9	11	13	10	12	8	6	3	72
B.S.	3462 3472	**Environmental Geology**	1	4	0	5	2	2	5	1	20
B.S.		**Geosciences Second. Ed**	0	0	0	0	0	0	0	1	1
		Total B.S. Graduates	10	15	13	15	14	10	11	5	93
		Total A.S., B.S., and Certificate Graduates	12	20	16	23	18	12	13	6	120

f. Student successes and recognition

The primary objective of the Geosciences Program is student success, as measured by students' skills and a successful transition to graduate school and/or into professional employment. The interaction between the Geosciences faculty and students is strong. Documentation of this synergy is reflected by the following student metrics and/or recognitions:

- During the 8-year reporting period, 14 students enrolled in graduate school in a geology-related field at several institutions (Colorado State University, University of New Mexico, Clemson University, University of Northern Colorado, Southern Illinois University, Central Washington University, and Emporia State). Subsequently, eight of these students received M.S. degrees; the remainder are still working on M.S. degrees.

  Other notable achievements related to post-graduate studies since the 2012 program review include: (1) two former students received tenure at their current teaching institutions (Dr. Alexis Navarre-Sitchler, Colo School of Mines; Dr. Sally Potter-McIntyre, Southern Illinois Univ.), (2) another student (Dr. Andy Darling) is currently employed as research faculty at U. of Georgia, and (3) another student (Dr. Mary Benage) received her Ph.D., from Georgia Tech and is a U.S. Geological Survey Research Geophysicist, at the Cascades Volcano Observatory in Vancouver.

- Using our program's data, which tracks graduates' career paths, 44 graduates obtained jobs in the geosciences and 8 have GIS-related jobs. **Including the students that pursued graduate studies, 71% of the B.S. Geosciences students that come through our program since 2013 have found employment in geology/GIS**

companies or pursued post-graduate degrees. Employers include the U.S. Army, various state and federal agencies (e.g., CDOT, U.S. Forest Service), mining and mineral resource companies, petroleum companies, oil-and-gas service companies (mudlogging and directional drilling), and GIS consulting.

- 33 student researchers presented their work at professional meetings including regional and national meetings of the Geological Society of America and the Society of Vertebrate Paleontology.

- 1 student was awarded the prestigious CMU Aspinall Scholarship.

- 5 students received external undergraduate research or travel grants to attend professional meetings.

- 1 student received a field camp scholarship from the Association of Women Geoscientists. Another student received a field camp scholarship from RMAG.

- 2 students received scholarships from the American Institute of Professional Geologists

- Each year, Geology students receive academic scholarships from endowed CMU Foundation scholarships including the Forrest Nelson Fund (principal = $700K), Geosciences Tuition Scholarship, the Richard D. Dayvault Memorial Scholarship, the Mark Garman Scholarship, and the Grand Junction Geological Society. A new scholarship to help fund student research is currently being finalized through the generous support of an alumna, Alexis Sitchler, and her husband.

- Each year, the top Geology students are recognized during Senior Day and receive non-cash awards including the Neal J. Harr Memorial Outstanding Geology Student Award given by the Rocky Mountain Association of Geologists in Denver, the Association of Women Geoscientists, the Verner C. Johnson GIS award, and the William C. Hood student research award.

4. PROGRAM RESOURCES

a. Faculty – curricula vitae are in **Appendix A.**

The Geosciences Program has six doctoral-level, tenured/tenure-track faculty members who became tenure-track faculty at CMU between 1985 and 2021 (two of the faculty began as full-time Instructors):

Verner Johnson	Ph.D.	1985-present	Professor
Rick Livaccari	Ph.D.	1997-present	Professor
Andres Aslan	Ph.D.	1999-present	Professor
Cassandra Fenton	Ph.D.	2019-present	Asst. Professor
Greg Baker	Ph.D.	2019-present	Assoc. Professor

Javier Tellez	Ph.D.	2021-present	Asst. Professor

The Geosciences Program currently has one full-time faculty Instructor:

Kerry Riley	Ph.D.	2018-present	Instructor

The Geosciences Program currently has several part-time Adjunct faculty members only two of whom will be teaching in 2022:

Julia McHugh	Ph.D.	2014-present	Museum of Western Colorado
James Walker	M.S.	2008-present	Technical Librarian
Marisa Connors	M.S.	2021	Yeh and Associates
Eric Farmer	M.S.	2021	Grand Junction High School

NOTE: Dr. Bill Hood has been an unpaid, non-teaching faculty member in Geosciences since 1998. Dr. Hood has played an integral role in procuring, operating, and maintaining the x-ray diffractometer, the x-ray fluorescence spectrometer, and supervises Geology students through Unconventional Energy Center grants. Without Dr. Hood's efforts, we would be unable to maintain our limited analytical facilities without compromising the collective efforts of the current faculty.

While each faculty member is required to teach a minimum of 24 credit hours per academic year (~4 courses per semester), almost all of the full-time faculty teach overloads due to program needs as well as due to Summer requirements (i.e. GEOL 480 Field Camp), which is not counted as part of the normal 24-credit load.

1) Student credit hours per FTE, faculty composition, and FTES:FTEF data

Table 4a presents data for the tenured/tenure-track Geosciences faculty, and indicates that they typically generate slightly less than 50% of the total student credit hours except for the past two years, which reflects the hiring of two new TT faculty. Between 2013-2019, the percentage of total student credit hours generated by full-time temporary faculty (Instructors) declined from 49% to 34% whereas the percentage increased for part-time faculty (Adjuncts) (2% to 26% in 2018-2019). These changes reflected the resignation/ retirement of Instructors discussed previously. The proportion of credit hours taught by TT faculty has increased significantly since 2019 as new TT faculty were added. **Table 4b** presents data that indicate that T/TT faculty are responsible for the vast majority of GIS-related student credit hours since 2017.

Table 4a. Percentage of Credit Hours Generated by Geosciences Faculty Type AY14-21.

	Total Student Credit Hours	Tenured/Tenure-Track	Full-Time Temporary	Part-Time
2013-2014	6495	49%	49%	2%
2014-2015	5760	47%	50%	3%
2015-2016	6695	45%	51%	4%
2016-2017	5890	43%	38%	19%

2017-2018	5295	56%	28%	16%
2018-2019	5740	40%	34%	26%
2019-2020	5881	66%	25%	9%
2020-2021	4913	66%	23%	11%

Table 4b. Percentage of Credit Hours Generated by GIST Faculty Type AY18-21.

	Total Student Credit Hours	Tenured/Tenure-Track	Full-Time Temporary	Part-Time
2017-2018	180	93%	0%	7%
2018-2019	168	70%	20%	10%
2019-2020	225	100%	0%	0%
2020-2021	230	100%	0%	0%

Table 5. Ratio of Full-Time Equivalent Students (FTES) to Full-Time Equivalent Faculty (FTEF).

Academic Year	FTES	FTEF	FTES:FTEF	% Change in FTES:FTEF
2014-2015	192	10	19.2	16.7%
2015-2016	223.2	10	22.4	0.02%
2016-2017	196.3	8.6	22.9	0.01%
2017-2018	176.5	7.7	23	0.01%
2018-2019	191.3	7.7	25	8.7%
2019-2020	196	7.9	24.8	-0.01%
2020-2021	163.8	7.5	21.7	-12.5%

Table 5 presents data indicating that the FTES:FTEF value increased steadily from 19.2 to 25 prior to 2019, which reflected substantial enrollment in 100-level courses despite the gradual decline in the number of full-time Geology Instructors. The marked decrease (12.5%) in 2020-2021 reflects a reduction in 100-level course offerings that was triggered by the retirement of two faculty members and re-assignment of existing faculties' teaching duties to cover upper-division courses.

2) Faculty successes/quality/recognitions

Geology faculty have been highly productive both in and out if the classroom. Over the reporting period, the majority of the tenure-track faculty publish their research (commonly with student co-authors) in peer-reviewed journals and have given presentations at regional, national, and international professional meetings (see CVs).

During the reporting period, a total of *33 peer-reviewed papers* and *74 abstracts were published*, and *22 professional presentations* were made by the Geosciences faculty. Many of the abstracts and several of the papers include CMU geology student co-authors. Faculty routinely lead field trips for professionals and the general public, and, in addition to professional presentations, give lectures to local community groups including the Grand Junction Geological Society, the Grand Junction Petroleum Club, and the Grand Junction Gem & Mineral Club. Over the reporting period, Geosciences

faculty have also given invited lectures at other universities (Colo State University, Southern Illinois University).

For the current reporting period, one Geosciences faculty member received the Outstanding Faculty Award. Geosciences faculty are frequently awarded the highest categories on their annual evaluations. Several of the faculty serve on graduate committees of students from other schools (U. of Oklahoma, Texas A&M, CU-Boulder). One faculty member was selected to participate in a special geology research forum (Thompson Field Forum), which involves a competitive application process (28 researchers from the U.S. and abroad were selected to participate). One faculty member was the Chair of the Rocky Mountain Section of the Geological Society of America and served on the advisory board of the Department of Geological Sciences at CU-Boulder.

One of the most underappreciated aspects of the Geosciences faculty efforts is the immense amount of time we spend on field trips with students not including student-faculty research efforts, which involves additional time spent with students in the field.

Table 6 presents data from a typical year (2018-2019) in the Geology Program. The data indicate that Geology Program faculty run ~100 field trips involving >700 students and >150,000 total student-hours (assuming weekend field trips are 8 hrs and weekday field trips are 2 hrs in length, which is an underestimate). This effort includes 35 days in the field (~280 hrs) on weekends, and does not include our efforts during the 6-week summer Field Camp.

For comparison a single 3-credit course at CMU is expected to involve 45 hrs/credit or 135 hrs of effort. The Geology Program faculty efforts on weekends therefore are producing the equivalent of two additional 3-credit courses each academic year.

These data demonstrate often-unmeasured component of the Geosciences Program (from the perspective of faculty time/effort accounting), but highlight the commitment of the entire faculty in continuing to provide exciting, hands-on, expert-led field experiences to CMU students.

Table 6. Geosciences field trip activity for 2018-2019 (AY19).

	# of field trips	# of field trip days	# of students
Course-related	**90**	**96**	**639**
weekday	71	71	214
weekend	19	25	425
Program-related	**7**	**10**	**99**
weekday	0	0	0
weekend	7	10	99
TOTALS	**97**	**106**	**738**

b. Financial Information

The department head submits a budget request to the administration each January for the upcoming fiscal year, which begins on July 1. Inasmuch as it has been many years since we have had to endure budget cuts, our working assumption is that we will receive the same amount as in the preceding year. Requests for one-time funds or base-building increases are approved based on justification and availability of funds. Recent examples of such one-time funds are for the purchase of a ~$8K rock crusher and additional funding to hire a second instructor for field camp.

The Geosciences Program collects course fees to offset the costs of lab supplies and field trips. **Table 7** shows costs for the Geosciences Program in the 2013-2014 (FY14) and 2018-2019 (FY19) fiscal years. Hourly compensation is for student assistants. Other current expenses include supplies, software, equipment purchase and repair, copier lease, and similar costs. Travel costs in the budget allocation category refer to faculty and student travel; much of this total is for field trips. Internal charges are for phones and phone calls.

Table 7. **Expenditures in 2013-2014 (FY 14) and 2018-2019 (FY 19). Student credit hours include all Geosciences classes (GEOL and GIST prefixes).**

Description	**FY 14**	**FY19**
STATE CLASSIFIED WAGES	$8,146.89	$7,316.13
STATE CLASSIFIED BENEFITS	$1,664.05	$3,997.03
FACULTY ADMIN REGULAR WAGES	$372,274.98	$347,348.00
FACULTY ADMIN TEMP WAGES	$164,391.48	$139,188.71
FACULTY ADMIN BENEFITS	$123,008.87	$102,261.63
HOURLY COMPENSATION	$2,628.19	$3,165.31
OTHER CURRENT EXPENSE	$33,946.73	$42,811.51
TRAVEL	$32,866.79	$41,883.93
INTERNAL CHARGES	$3,247.80	$2,453.05
TOTAL	**$742,175.78**	**$690,425.30**
Student Credit Hours	6447	5908
Dollars per Credit Hour	**$115.12**	**$116.86**

1) Internal/External funding related to faculty grants

Geosciences faculty have received approximately $525,000 in funding since the last program review. Nearly $100K came from the National Science Foundation (PI – Aslan in 2011-2014). Grants from the CMU Unconventional Energy Center (PIs Aslan, Cole, Hood, and Johnson) totaled approximately $157K. The Grand Junction Geological Society awarded ~$5K to research projects by Rex Cole and equipment upgrades related to Bill Hood's research. Bill Hood received $3,725 from the CMU Hutchinson Water Center for a student-faculty research project, and Bill procured approximately $130K from various oil companies to upgrade our XRD, purchase a new XRF and muffle furnace, and to repair equipment. Faculty have also received a large

number of Faculty Professional Development Fund Grants (generally $1-2K each) during the reporting period.

Since 2013, ESRI donated nearly $400,000 worth of Virtual Campus Courses and evaluation copies of ArcGIS software to students in the Geosciences and GIS&T programs.

c. Library assessment

Library personnel have prepared an assessment of holdings related to the Geosciences program. See **Appendix B**.

d. Physical facilities

The Geosciences program has facilities in the Wubben Science Center, including:

WS 150	Classroom (for upper-level geology courses)
WS 152	Student work room and mineral separation lab
WS 152A	Faculty preparation and storage room
WS 152B	William C. Hood and John Scholes X-ray diffraction lab
WS 154	Noble Energy classroom (for upper-level geology courses)
WS 147	GIS&T Lab (for GIS-GPS and other computer-oriented courses, 18 person)
WS 163	Physical and Historical Geology Lab (24 person)
WS 145	Storage space
WS 143	Storage space
WS 102	Storage space

e. Instructional resources, materials, technology, and equipment

Equipment holdings in geology include:

- Rigaku Miniflex x-ray diffractometer
- hand-held Bruker x-ray fluorescence unit
- magnetometer
- portable refraction seismometer
- 8 functioning binocular polarizing microscopes
- 15 functioning binocular microscopes
- 12 recreational-grade geographic positioning system (GPS) units
- 1 survey-grade GPS unit
- oil-bath diamond saw
- thin section machines (1 is operable)
- 2 stream tables
- 1 outcrop mini-permeameter

The computer resources in the GIS&T lab include computationally fast, high-memory-capacity computers for students and one for the instructor, one high-resolution plotter, one large light table, one color printer, and one color plotter. Computers in the lab were replaced in 2021. Participation in the ESRI statewide license agreement now allows for GIS software to be used in this lab and throughout campus. Rooms WS 150 and 152 also have a total of 3 general-use computers.

f. Efficiencies in the way program is operated

Equipment is shared among many courses and is used by Physics and Environmental Science faculty on occasion (e.g., x-ray diffractometer). The GIS software site license is obtained by a collaboration between most Colorado institutions, which allows us to obtain the license from ESRI at a discount. In addition, the equipment is often critical to student research projects as well as interfaces with local and regional research partners.

5. STUDENT LEARNING OUTCOMES AND ASSESSMENTS

a. Geosciences student learning outcomes (SLOs)

In the spring semester of 2014, the Geosciences faculty composed and instituted the programmatic student learning outcomes (SLOs) listed below for all Geosciences degrees. These SLOs were designed to contribute toward the Geoscience program's mission and goals as well as to aid students in achieving the institution-wide SLOs.

Geosciences Student Learning Outcomes (SLOs)
1. Articulate the fundamental knowledge base and ideas of the major fields of geoscience (specialized skills in geoscience)
2. Collect and interpret geoscience field data (problem solving skills)
3. Collect and interpret geoscience laboratory data (problem solving skills)
4. Use technology (e.g. computer software) for evaluating quantitative geoscience data (technology skills)
5. Write an effective report on a geoscience study (communication skills)
6. Demonstrate an effective oral presentation on a geoscience study (communication skills)

These SLOs were chosen so that Geosciences graduates will be well-prepared for graduate schools, industry jobs, and a variety of other positions within the sciences. Furthermore, these SLOs are set up to give students the skills necessary for on-going independent learning beyond the classroom. The curriculum map for the Geosciences Program indicates the courses in which these SLOs are covered, and it is included in **Appendix C**.

As a result of aligning the program SLOs with the institutional SLOs (e.g., Critical Thinking, Communication Fluency, Applied Learning, and Quantitative Literacy) geology students are prepared for a wide variety of positions outside the sciences. In the Geosciences courses that serve CMU's Essential Learning Curriculum (GEOL 100, 103, 104, 106, 107, 108, 111, 111L, 112, 112L, 113, and 113L) students are given tools to help them progress

toward the University's Essential Learning SLOs such as Critical Thinking, Applied Learning and Quantitative Literacy.

b. Measurements that assess SLOs (Program Assessment Report)

The SLOs are assessed by analyzing several measurement implements, including entire exams, specific exam questions, written reports, oral presentations, laboratory work, data analyses, and proposed procedures. These assessments, along with their results and resultant actions, are described in the Program Outcome and Assessment Report (**Appendix D)**. Each SLO is assessed at a minimum of two levels from the beginning, developing, and advanced levels of the Geosciences curriculum. By assessing at more than one level, we are able to get a better picture of where issues may be occurring with respect to students' attainment of the SLOs.

Beyond the assessments described in the Program Outcome and Assessment Report, the Geosciences program also assesses itself through reflection on how readily students are able to obtain positions following graduation. The Geosciences program faculty generally receive the compiled assessment data and meet to discuss it once a year. Since the beginning of 2014, a timeline has been kept of when the Geoscience faculty have reviewed and discussed assessment data, and this timeline is included at the beginning of the Program Outcome and Assessment Report (**Appendix D**).

SLO #1: Articulate the fundamental knowledge base and ideas of the major fields of geoscience (specialized skills in geoscience).

At the advanced level, SLO #1 is assessed using the Geoscience exit exam. This exam was compiled from questions submitted by all Geosciences faulty. The Geoscience exit exam for senior geoscience students is a part of the capstone GEOL490 Senior Seminar course. It assesses the students overall Geoscience knowledge and problem-solving skills. We require all of our senior Geoscience students to take this exam during the semester before they graduate.

Summary results of the Geoscience Exit Exam

	Number of Students	Number of Sections	Average Score	Median Score
Spring 2014 – 2021	100	8	78%	78%

The expectation agreed upon by the Geoscience faculty is that the students must attain a score of >65% on this exam to be eligible for graduation. From 2014 to 2021, 94% of students scored >65% and only 6% of students scored <65%. Several of the students that did not do well on the exit exam were students that transferred to CMU.

While the Geoscience exit exam assesses students' technical fluency in the major fields of Geoscience (SLO #1) at the advanced level, this SLO is also assessed at the beginning level using final exams in GEOL111 and GEOL 113. In order to obtain a clear picture of how

all the students at these levels are performing, these scores are assessed on a yearly basis, and the results are tracked over time.

Assessment exam scores for GEOL111 and GEOL113 showed an average increase of 94% from the beginning to the end of each semester (including all sections) for the data collected from Spring 2014 to Spring 2021 (*n* = 1278 students; 43 sections). This indicates that the students are achieving satisfactory levels of fluency in these subjects at the beginning level.

SLO #2: Collect and interpret geoscience field data (problem solving skills).

SLO #2 is assessed at the developing level in GEOL 202: Introduction to Field Studies and at the advanced level in our capstone course GEOL 480: Summer Field Camp (A). All Geoscience majors are required to take both of these courses.

At the developing level, SLO #2 is assessed with a final project, which is a geologic field mapping project. This field mapping project is delivered as the final project for GEOL 202. The students are assessed based on the accuracy of their geologic mapping (50 pts), the accuracy of the accompanying cross section (20 pts), and the quality of the field observations recorded in field notebooks (30 pts).

Summary results of the GEOL 202 Field Mapping Project

	Number of Students	Number of Sections	Average Score	Median Score
Fall 2013 – Spring 2021	122	12	87%	90%

Every year, our goal was to have at least 80% of the students score >70% on the final mapping project. The result was that 100% of students scored >70% on the final mapping project, so we achieved our goal.

At the advanced level, SLO #2 is assessed in the GEOL 480: Field Camp course, which is offered every summer. In GEOL 480 students complete six week-long field projects. GEOL480 students are assessed based on the accuracy of their geologic mapping (50 pts), the accuracy of the accompanying cross section (25 pts), and the quality of the field observations recorded in field notebooks (25 pts).

Summary results of the GEOL 480 Field Mapping Project

	Number of Students	Number of Sections	Average Score	Median Score
Spring 2016 – 2021	88	8	86%	87%

Consistent scores averaging 86% are considered a positive indication that Geoscience graduates are proficient at field geology and geologic problem solving.

SLO #3: Collect and interpret geoscience laboratory data (problem solving skills).

SLO #3 is evaluated at both the developing and advanced levels. At the developing level, students in GEOL 331L: Crystallography and Mineralogy Lab, are evaluated based on their ability to identify unknown mineral specimens. They are also expected to collect minerals in the field as part of a mineral collection that they turn in at the end of the semester for lab credit. To be successful at mineral identification students must use the textbook reading materials on the physical properties of minerals. In the lab, students are given about 30 unknown mineral specimens every two weeks. Students must use the physical properties of minerals such as crystal form, hardness, cleavage, twinning, color, etc. to identify these minerals. In the field, students must collect and identify minerals based on their physical properties for use in their mineral collection that they turn in at the end of the semester. The target score we set for this exercise is 70%. Overall class average score for the 3-year period of 84% exceeds the target score of 70%.

At the advanced level, SLO #3 is assessed in GEOL444/444L: Sedimentology and Stratigraphy and Lab. This assessment involves a final project of fluvial depositional systems using information presented in lecture (GEOL444) coupled with a six- to eight-hour field exercise (GEOL444L) where data are collected on an ancient fluvial sequence at Riggs Hill near Grand Junction. In lecture (GEOL444), students are given reading materials on the spectrum of fluvial depositional systems, coupled with detailed lectures. In the field (GEOL444L), students must generate sedimentologic data (sandstone-body thickness, lithofacies types, stratal surfaces, paleocurrents, and three-dimensional architecture) on a fluvial complex at the Jurassic-Cretaceous boundary. Students are required to use their field data to interpret the origin of the sandstone body based on the materials presented in lecture and the reading assignments. Students are required to write a report discussing their data and interpretations. This exercise is worth 100 points; the grading breakdown is as follows: accuracy of sedimentology data collected in field (50 points), quality of final report (40 points), and neatness (10 points). The students evaluated from Spring 2015 to 2021 earned an average score of 91% indicating that they are performing very well with respect to SLO #3.

Summary results of the GEOL444/444L Final Project

	Number of Students	Number of Sections	Average Score	Median Score
Spring 2015 – 2021	86	7	91%	91%

SLO #4 Use technology (e.g. computer software) for evaluating quantitative geoscience data (technology skills).

SLO #4 is assessed at the developing level in GEOL204: Computer Applications in Geology. In this course, students are required to develop computer skills for geologic-related problems and utilize the following software: Excel, PowerPoint, and ArcGIS. The final project includes both subsurface geologic maps (well location map and contour maps) of the Dakota Group from the petroleum well data in ArcGIS and includes a five-page written report. The students are assessed based on the accuracy of their geologic maps (60 pts), the quality of the petroleum information (location, depth, and production history) in Excel (10 pts), and a written report (30 pts). The written report includes an abstract, introduction, production history, data gathering, computer generation, and analysis.

The goal is a class average that exceeds 70 points (total = 100 points); i.e., a minimal "C" grade. The results given in the below table indicates that the students are doing an excellent job with respect to this SLO.

Summary results of the GEOL204 Final Computer Project

	Number of Students	Number of Sections	Average Score	Median Score
Fall 2013 – Spring 2021	92	13	87%	8%

SLO #5: Write an effective report on a geoscience study (communication skills).

At the advanced level, SLO #5 is assessed in GEOL 490: Seminar. In this course, students write a 15-page (not including figures and tables) report that covers the independent research completed during GEOL 490. This project is assessed via rubric to rate students on a scale of 1-to-5 for the following categories: 1) depth of research/content and analysis; 2) appropriateness of methods and approach, 3) organization and professionalism of the report, and 4) clarity of writing and proper use of grammar and terminology.

90% of the students scored ≥4.0 in two of the four categories, indicating that the students are doing an excellent job with respect to this SLO. This high performance is based in part on the fact that the students are required to present their findings two times in the Spring semester (CMU Student Showcase, April meeting of the Grand Junction Geological Society) so the students generally do a thorough job.

Note that with the addition of new faculty, this SLO is also being evaluated using another 200-level course (GEO 204), but data has yet to be collected in this course.

SLO #6: Demonstrate an effective oral presentation on a geoscience study (communication skills).

SLO #6 has been evaluated at the advanced level in two courses GEOL 359: Survey of Energy Resources and GEOL 490: Seminar. However, with the retirement of Rex Cole,

GEOL 359 is not currently taught. As in the case of SLO #5, GEOL 204 will be used to further evaluate this SLO in the future.

In GEOL 490, students are assessed with a 15-minute presentation that covers independent research completed during GEOL 490. In addition, 5-10 minutes of questions by peers and the instructor follow the presentation. This project is assessed using a rubric that rates them on a scale of 1 – 5 for the following categories: 1) depth of content and analysis; 2) quality and professionalism of presentation including organization and preparedness, 3) quality of PowerPoint slides including their clarity and depiction of appropriate material and grammar, and 4) ability to answer questions. 92% of students in each section scored a $\geq$4.0 in two of the four categories suggesting that students are performing well in this SLO. Again, the high performance is based in part on the fact that the students are required to present their findings two times in the Spring semester (CMU Student Showcase, April meeting of the Grand Junction Geological Society).

In GEOL 359 student assessment is based on a fossil-energy topic that students choose early in the semester and research for approximately two months. During the last 1-2 weeks of the class, each student makes a 20-minute oral presentation using slides, videos, transparencies, or PowerPoint on the topic, followed by five minutes of questions. A handout (with abstract) summarizing their presentation is also provided to the other students and the professor. Evaluation involves input from fellow students (peer review) and the professor. A total of 100 points (equivalent to one exam) are tied to the project. Students from the three sections assessed scored an average of 85% suggesting that they are doing well in this SLO.

c. Student satisfaction (Summary of CMU alumni survey)

Responses of alumni from the Geosciences Program (n = 20) are compared with responses of Colorado Mesa University (CMU) alumni in general (n = 778). The alumni survey results are in **Appendix E**. Responses from Geosciences alumni were comparable to or more positive than responses from CMU alumni overall regarding their education. All of the Geosciences alumni stated that they were "Very Satisfied" (55%) or "Generally Satisfied" (45%) with their undergraduate education, and all but two of them rated the quality of their education within the Geosciences program as "Very High" or "High". The remaining two rated the overall quality of their geosciences education as "Average."

The Geosciences faculty take pride in the personal instruction, mentoring, and student-faculty research that we offer, and this was reflected in alumni responses to: "While an undergraduate, about how often did you have conversations with faculty outside of class?" Sixty percent (60%) of our Geosciences alumni responded with "Very Often (at least once a week)," indicating frequent interaction with Geosciences faculty outside of class activities. In sharp contrast, only 38% of CMU alumni responded "Very Often (at least once a week)." Thirty percent of Geosciences alumni noted they interacted with faculty "Often (once every two weeks)." All Geosciences alumni responded that they at least had conversations with faculty "Occasionally (3-5 times per semester)."

Seventy-one percent (71%) of our Geosciences alumni participated in student-faculty research, and describe their experiences as very beneficial to beneficial, particularly with regard to how research prepared them for future employment. Eighty-five percent (85%) and 75% of our Geosciences alumni "Agreed" or "Strongly Agreed" that Geosciences faculty cared about the students' education and well-being, respectively. Specific alumni comments were mainly positive with statements that faculty were supportive. Geosciences alumni also stated that their degree prepared them well for employment and further education. Multiple alumni praised the Geoscience facultys' use of Colorado/Utah geology in field labs and studies to emphasize topics introduced in the classroom. The alumni generally agreed that this extra hands-on field approach gave them a better understanding of geology. There were a few comments, however, that the Geosciences program would benefit from more and new laboratory equipment, to teach basic laboratory analysis skills.

Perhaps the main area in which Geosciences alumni thought the CMU Geosciences program lagged behind was in career services. Geosciences alumni indicate they generally felt that there could be increased opportunities for networking with local and regional employers. Alumni also underscored what they saw as a lack of information about career paths and employment opportunities. The Geosciences Program has already begun to address these issues. In spring 2019, we updated our website to include a "*Geosciences Job Outlook*" section based on statistics published by the Bureau of Labor. We have also added a new webpage "*Geosciences Resources*" that directs CMU students and potential recruits to resources they can use to find information about employment, internship, graduate school, and funding opportunities.

Employment statistics show a very positive reflection of employment and earnings of our Geosciences alumni. In the survey, 90% of the Geosciences alumni that responded were working full-time for pay, and all but three were working in a position related to geosciences. The Geosciences alumni all responded that CMU prepared them "Very Well", "More than Adequately", or "Adequately" for their current careers. The majority of the Geosciences alumni (53.4%) who responded are earning between $50,000 and $74,999 annual gross income (before taxes). In contrast, sixty-two percent (62%) of CMU alumni overall earn less than $49,999 annual gross income (before taxes)

Of the four geosciences alumni that pursued further education and responded to the alumni survey, two graduates responded that CMU had prepared them "More than Adequately" for their post-graduate education program; two alumni responded with "Adequately". Among these students, three alumni were pursuing master's degrees in geosciences or hydrogeology. The other alumnus is pursuing a Master's in Business Administration. Institutions where alumni are working on or have completed their post-graduate degrees include Clemson University, University of Texas Permian Basin, Emporia State University, and an undisclosed institution (MBA program). Two graduates completed their educational program and two were in the process of completing their program.

d. How are student learning outcomes being refined?

Evaluation of our assessment techniques has led the Geosciences faculty to conclude we have successfully accomplished our goals, meeting our benchmarks for educating and assessing our students. The above-average percentage (in the 80s) also leads us to conclude that we should review our assessment techniques. In our opinion, these values might indicate we are not 'challenging' our students enough. We have recently hired two new TT faculty, and we are preparing to revamp our Environmental Geology curriculum. As our program evolves over the next several years, we will use the time to re-evaluate our Assessment Plan.

6. FUTURE PROGRAM PLANS

a. Vision for Geology

The Geology program offers up-to-date degree programs that provide students with technical and professional skills necessary for careers in the geosciences or further education in graduate school. Given the quality and experience of the tenure-track faculty and our location in western Colorado, the CMU Geosciences Program could be one of the best geology programs in the western region among similar 4-year institutions. The Geosciences Program has the potential to offer a M.S. professional (non-thesis) degree in Geology.

b. Strengths and challenges facing the Geosciences program

Strengths

- **Field-based learning opportunities**. Numerous Geology class field trips such as the Western Slope Field Conference and the 6-week summer Field Camp course ensure that CMU Geology students gain substantial field experience during their undergraduate careers.

- **Student-faculty research**. Each geology student completes an individual research project that is presented at the CMU Student Showcase and the Grand Junction Geological Society. Students are afforded a large number of research-based learning opportunities outside of the classroom, which help in their preparation for careers in the geosciences as well as graduate studies.

- **Innovative degree options**. The Watershed Science minor and related hydrology-oriented courses are a rare curriculum option for a 4-yr undergraduate institution. The GIS&T minor and certificate program also afford students with additional career options, in addition to traditional Geology careers.

- **Active student club**. The student chapter of the American Association of Petroleum Geologists provides interested students to attend lectures, professional meetings and field trips that enhance their career opportunities.

- **Forrest Nelson Fund**. The generous donation to create the endowed Forrest Nelson Fund permitted the Geosciences Program to allocate $15-25K to student scholarships over the past two years (began in 2019; this will continue into the future). This money is critical to the needs of our under-represented students who have limited financial resources.

Challenges

- **Recruitment of Geology majors**. Geology is an "opportunistic" major. Very few (usually <5 based on surveys that the program takes in 200-level courses) students show up at CMU with the intention of majoring in Geology. Like most colleges and universities, Geology majors transfer into the degree program from some other major as a result of taking a 100-level course. One recent innovation to recruit Geology majors is the GeoDay Hike, which is offered over the weekend between Orientation and the first day of classes in fall semester.
- **Equipment and Research Lab space**. We would significantly benefit from 1) a research workroom for describing, processing and analyzing sediment samples and cores (work/dirty lab), 2) a new XRD, and 3) a research-grade XRF.
- **Maintenance of existing equipment.** We do not have adequate human resources to maintain existing equipment such as the XRD. Dr. Bill Hood has done this for the program as an unpaid adjunct faculty member. When Bill Hood "retires" from this role, we will be in trouble.

c. Discipline trends and future program initiatives in Geosciences

Environmental geology is currently the main source of employment in the Geosciences. We are undertaking a re-organization of the Environmental Geology B.S. curriculum, and are modernizing the degree by implementing new classes and degree requirements. These changes will go into effect in 2022 and include the addition of a geochemistry course, strengthening of the ground water hydrology requirement, and the creation of a new course that combines surface water hydrology and river dynamics. These courses will also support the Environmental Science curriculum at CMU.

d. Recommendations

1) **Infrastructure** -- Develop a financial plan for maintaining and replacing existing equipment such as the x-ray diffractometer (~$100K piece of equipment) and procure new research space. Students need more lab facilities (equipment/instrumentation) to work on research projects. We also need help with the maintenance of research-grade equipment – Bill Hood, a retired geologist and non-teaching adjunct, has donated his time and energy to fulfill this role, but relying on Bill is not sustainable in the long term.

2) **Create a Geosciences Program Board** – Solicit professional geologists from the area to help improve student job and funding opportunities as well as to provide advice on program activities and initiatives.

3) **3-D Visualization Lab** – One technologically oriented suggestion is to create a 3-D Visualization Lab. This lab would be used in courses across all levels and for student-faculty research. This type of facility is used elsewhere in the petroleum industry and would significantly enhance technology skills of Geology students.

7. COVID ADAPTATIONS AND LESSONS LEARNED

a. COVID adaptations

In March of 2020, the CMU campus transitioned to online course delivery. In Fall of 2020, online delivery continued in conjunction with hybrid (partial in-person and online) courses. Spring and Fall 2021 saw the return of traditional in-person classes supplemented by online courses. COVID impacts on the Geosciences Program teaching were very substantial. Because of our field-based course emphases and our specific field courses (GEOL 113/113L – Field-based Physical Geology & Lab; GEOL 202 - Introduction to Field Studies; GEOL 480 – 6-week Summer Field Camp), the transition to online teaching was disruptive, to put it mildly. Adaptations included the following: GEOL 113 required students to drive themselves on field trips, GEOL 202 was cancelled, and GEOL 480 only enrolled 2 students – we encouraged students to hold off on Field Camp until they could take it over a "normal" summer. Prof. Rex Cole retired in Spring of 2020 and although a faculty search was underway and within days of completion, the position was frozen so that the faculty were short-handed during Fall of 2020 and Spring 2021. Faculty adapted by teaching overloads and teaching courses that they had not taught previously. It was literally all-hands-on-deck. Several of the faculty (Aslan, Fenton) taught 100% online for parts of 2020 and 2021 so the presence of Geosciences faculty on campus was greatly reduced during COVID. As of Fall 2021, the entire faculty are back on campus.

b. Lessons learned

Online teaching has a dramatic impact on teaching geology courses, especially for a field-based program such as ours. The quality of education for students that have taken upper-division geology courses online is probably less than those who previously (pre-COVID) took in-person classes with field components.

APPENDIX A

Curricula Vitae for Full-Time Faculty

COLORADO MESA UNIVERSITY
Department of Physical and Environmental Sciences
1100 North Avenue • Grand Junction, CO 81501-3122
Phone (970) 248-1993 • FAX (970) 248-1700

ANDRES ASLAN

Dept. of Physical and Environmental Sciences, Geosciences Program
Colorado Mesa University (formerly Mesa State College)
(970) 248-1614, aaslan@coloradomesa.edu

TECHNICAL EXPERTISE & RESEARCH INTERESTS

Geomorphology (Rocky Mountains, Colorado Plateau)
Modern and Ancient Depositional Systems (Mississippi River/Delta, Orinoco Delta)
Quaternary Age Dating and Landscape Evolution (Colorado & Green Rivers)
Sedimentology of Siliciclastic Sedimentary Systems (Colorado Plateau)
Sea Level, Climatic, and Tectonic Influences on Stratigraphic Architecture (Gulf of Mexico)
Detrital Zircon and Sanidine studies (Rocky Mtns, Colorado Plateau)
Paleosols and Paleoclimate Records (Rocky Mtn region)

Research Gate Profile: https://www.researchgate.net/profile/Andres-Aslan/stats
RG Score = 27.6

ADMINISTRATIVE & PROFESSIONAL SERVICE EXPERIENCE

2013-present, Coordinator, Geosciences Program, Colorado Mesa University
Past Chair & Board Member, Rocky Mtn Section, Geological Society of America
Past Member, Advisory Board, CU-Boulder Geosciences
Past Member, CREST (Colorado Rockies Experiment and Seismic Transects)

EDUCATION

Ph.D. Geology (1994)	University of Colorado-Boulder
M.S. Geology (1990)	University of Colorado-Boulder
B.S. Geology (1986)	Brown University

PROFESSIONAL AND TEACHING POSITIONS

Colorado Mesa U. Geosciences Program Coordinator, 2013 to present
Professor of Geology, 2007 to present
Associate Professor of Geology, 2002-2007
Assistant Professor of Geology, 1999-2002

Bureau of Economic Geology, U. of Texas at Austin, Research Associate, 1998-1999.
Mary Washington College, Senior Lecturer, 1997-1998.
Virginia Wesleyan College, Visiting Assistant Professor, 1996-1997.
Oberlin College, Visiting Assistant Professor, 1995-1996.

RESEARCH AND WORK EXPERIENCE SUMMARY

Colorado Mesa University/Mesa State College, Faculty 1999-2021. I have supervised >100

senior theses and have had numerous research students present at local and national geologic meetings. Research projects have included:

1) ***Long-term evolution of the Colorado and Green River systems.*** Work involves field mapping, detrital zircon/sanidine studies, and cosmogenic dating of fluvial terraces to document spatial and temporal patterns of river incision. Innovative use of detrital sanidine data offers potential to transform dating of fluvial deposits.
2) ***Late Cenozoic mantle-driven uplift of the Colorado Rockies.*** Combines data on ancient river histories with mantle tomography to decipher Neogene uplift history.
3) ***Neogene (U/Th)/He apatite thermochronology and exhumation history of western Colorado***. Complimentary to investigation of river incision histories; HeFTy modeling of He data to constrain exhumation in upper Colorado River basin.
4) ***U-Pb detrital-zircon geochronology and paleogeography of Tertiary fluvial systems, southwestern Green River basin, and northwestern Colorado***. Field mapping and DZ data are combined to constrain timing and provenance of late Eocene through Miocene evolution of fluvial systems.
5) ***K-T boundary and enigmatic fluvial conglomerates of western Colorado and eastern Utah***. Mapping, stratigraphic studies, and DZ data are used to correlate and interpret conglomeratic units of the Tertiary(?) Dark Cyn Mbr of the Wasatch Fm and the Cretaceous(?) Ohio Ck Conglomerate.
6) ***Avulsion history of the Mississippi-Atchafalaya River system, Louisiana***. Used shallow cores and ^{14}C data to document timing and factors responsible for avulsion of large river systems.

Courses taught at CMU include:

Physical Geology, Historical Geology, Natural Hazards & Environmental Geology, Geology of Colorado, Geomorphology, Sedimentology, Senior Seminar, Field Camp, Structured Research

Homeland Uranium, Inc., Sedimentologic consultant 2007-2009. ***Sedimentology of uranium-bearing ore deposits in the Salt Wash Mbr. of the Morrison Fm., southwest Colorado (Uravan district)***. Duties included field studies, core description, log correlation, resource assessment.
Bureau of Economic Geology, U. of Texas at Austin, Project sedimentologist 1998 to 1999. ***Geo-environmental study of the Orinoco Delta in Venezuela.*** Designed and executed field studies, used remote sensing (radar, Landsat TM) and field data (GPS surveys, shallow cores) to document depositional systems and active geologic processes of the Delta. Member of multi-disciplinary team in the Environmental Group at the BEG.
Howard University-Geological Survey of Pakistan, Project sedimentologist 1991 and 1997. ***Eocene paleosols of the Kuldana Fm. and implications for whale evolution***. Conducted field and petrographic studies of Eocene alluvial paleosols and coastal-plain deposits in the Kohat Basin, Pakistan as part of a study on whale evolution. Collaborator: Dr. Hans Thewissen (NEOUCOM).
University of Nebraska, Sedimentologic consultant summers of 1995 and 1996. ***Avulsion, paleosols, and Quaternary evolution of the Colorado and Trinity Rivers, south Texas***. Conducted field, mineralogic, and petrographic studies of Quaternary fluvial deposits and alluvial paleosols along the Texas Coastal Plain. Collaborator: Dr. M.D. Blum (U. Kansas).

University of Colorado, Research associate 1995-1996; Research assistant 1987-1994.
1.Holocene evolution of the Mississippi River floodplain, south Louisiana.
Ph.D. dissertation: Field studies including shallow coring of fluvial-deltaic sediments, geologic mapping, and petrographic and geochemical analyses of Holocene floodplain sedimentation and soil formation in the Lower Mississippi Valley.
2.Paleosols and paleohydrology of the Eocene Willwood Fm., Bighorn Basin, WY.
M.S thesis.: Used field, petrographic, and geochemical data to decipher depositional and hydrologic histories of alluvial paleosols in Wyoming.
Louisiana State University, Research associate 1992-1995. Collaborator on Quaternary field mapping projects in Louisiana with Dr. W.J. Autin (Louisiana Geological Survey/L.S.U.).
Shell Oil Co. Houston, TX, Geologist in Gulf Coast Tertiary Exploration summer of 1990.
Regional study of deltaic sandstones of the Eocene Wilcox Fm., south Texas. Used electric well logs and correlations to produce a computer database for generatig stratigraphic cross sections and sand isopach maps.
Smithsonian Institution, Research assistant in the Dept. of Paleobiology 1986-1987. ***Bone accumulations and vertebrate taphonomy in rivers in Colorado and Wyoming*** Conducted field studies and established a computer database on experimental bone distributions in modern rivers. Supervisor: Dr. A.K. Behrensmeyer.

RESEARCH GRANTS
$33,000 (2019-present) Detrital sanidine dating of ancient sedimentary rocks. Unconventional Energy Center, Colorado Mesa U.
$34,000 (2014-2017). Neogene exhumation history of the upper Colorado River basin. Unconventional Energy Center, Colorado Mesa U.
$94,870 (2011-2014) 3 yr NSF Grant, Continental Dynamics, Collaborative Research: Mantle-driven uplift and evolution of the Rocky Mountain region.
$362,000 (2005-2008) NSF REU-Site Grant. Landscape evolution of western Colorado.
$12,000 – (2005-2006) BLM grant. Geoarcheology of the Little Dolores River Valley.
$15,000 – (2003-2004) BLM grant. Geoarcheologic study of Sieber Canyon, Uncompahgre Plateau.
$25,000 – (2001) American Chemical Society Petroleum Research Fund Grant, Mississippi River response to sea level fluctuations.
ADMINISTRATIVE AND SERVICE EXPERIENCE
Geosciences Program Coordinator & Faculty Member. >20 years of experience teaching; the last 5 years coordinating the Geosciences program at CMU. Coordinator duties include supervising program activities, organizing faculty schedules and teaching assignments, review of program budgets and geosciences CMU Foundation accounts, coordinating program initiatives, and serving as the point person for Geology activities on campus. Faculty duties include teaching 10-12 classes per year, maintaining a research program that involves undergraduate students, serving on campus-wide committees, advising students, and maintaining an active professional role in the Geosciences community. To do all of the above, especially given the significant teaching load, requires strong organizational and time-management skills. Specific contributions that I have made to the CMU campus and the Geosciences program include:

Coordinator of the Student Scholars Symposium for ~10 years prior to its transformation to a campus-wide event (Student Showcase). I kept the Symposium “alive” until

it was recognized that this valuable student-centered activity should be made into a campus-wide event.

Geosciences Senior Day – I created this event to honor graduating seniors, recognize specific students for individual achievement, and to prepare seniors for their capstone presentations, which they then present to the Grand Jct Geological Society and at the Student Showcase. I organize and "emcee" this event each year.

Geosciences presentations to the Grand Jct Geological Society – I am in charge of organizing all the senior student presentations at the April GJGS meeting each year.

Spring Geosciences program field trip – I developed a spring field trip (the Adam Trumbo Memorial Field Trip) to provide the program with a spring "event" to allow students and faculty to interact each year in a meaningful way.

Western Slope Field Conference – I am the main faculty member that attends and organizes student attendance at this annual event among CMU, Western State, and Ft. Lewis College.

CMU. Tenure & Promotion Committee (numerous years), Pre-Tenure & Promotion Committee (past Chair), Student Showcase/Scholars Day (past Chair), Professional Development Fund (past Chair), Faculty Search Committees (past Chair)

Chair & Board Member, Rocky Mtn Section, Geological Society of America. From 2011-2014 served the Rocky Mtn Section of GSA organizing board meetings, reviewing financial information, developing initiatives, reviewing grant proposals.

CREST (Colorado Rockies Experiment and Seismic Transects) project. Participated from 2007-2010 in multi-disciplinary Geology research program involving ~10 U.S. geology institutions and ~30 researchers with expertise in seismology, geodynamics, structural geology, stratigraphy, geochronology, geochemistry, thermochronology, and geomorphology. This project provided me with invaluable experience with regard to working on a large-scale project involving a wide range of scientific expertise.

SELECTED PROFESSIONAL ACTIVITIES

2019 – Theme session co-Chair, GSA National Meeting, Phoenix
2018 – Theme session co-Chair, Rocky Mt Section, GSA Meeting
2016 – Theme Session co-Chair and Field Trip Leader, GSA National Meeting
2011-2014 –Chair & Mbr Rocky Mt Section Mgt Board, Rocky Mt Section of GSA
2013 – Theme Session Chair and Field Trip Leader, GSA National Meeting
2010 – Theme Session Chair and Field Trip Leader, GSA National Meeting
2007 – Theme Session Chair and Field Trip Leader, GSA National Meeting
2005 – Technical Program Co-Chair, GSA Rocky Mt Section meeting
2005 - Field Trip Leader, GSA Rocky Mountain Section Meeting
2005 - Technical Session Co-Chair, GSA Rocky Mountain Section Meeting
2001 - Field Trip Leader 7th International Fluvial Sedimentology Conference

PEER-REVIEWED JOURNALS & BOOK CONTRIBUTIONS (CMU faculty/students in bold):

Zhu, Lu, Fan, M., **Aslan, A**., and Smith, J.J. (in review) Volcanic glass hydrogen isotope evidence

for Cenozoic surface uplift of the southern Rocky Mountains. Geological Society of

America Bulletin.
Albonico, M., Karlstrom, K.E., Heizler, M.T., Gillam, M.L., **Aslan, A**., and Crossey, L. (in review). The birth and incision history of the San Juan River in the past 5 Ma. Geosphere.
Walker, J., Aslan, A., Cole, R.D., and Heizler, M.T. 2021. New age constraints on the Late Cretaceous Lower Williams Fork Formation, Coal Canyon, Colorado. The Mountain Geologist, v. 58, p. 5-26. DOI: 10.31582/rmag.mg.58.1.5
Aslan, A. Karlstrom, K.E., Kirby, E., Heizler, M.T., Granger, D.E., Feathers, J.K., Hanson, P.R., Mahan, S.A., 2019. Resolving time-space histories of Late Cenozoic bedrock incision along the Upper Colorado River, USA: Geomorphology, v. 347, p. 1-26 https://doi.org/10.1016/j.geomorph.2019.106855
Aslan, A. Boraas-Connors, M., Sprinkel, D., Becker, T.P., Lynds, R., Karlstrom, K.E., and Heizler, M. 2018. Cenozoic collapse of the eastern Uinta Mountains and drainage evolution of the Uinta Mountains region: Geosphere, v. 14, no. 1, p. 115-140.
Jarrin, D., Aslan, A., Mahan, S., and Hanson, P.R. 2017. New age constraints on Late Pleistocene glacial outwash deposits near Ridgway, Colorado, northern San Juan Mountains. In Karlstrom, K.E., Gonzales, D.A., Zimmerer, M.J., Heizler, M., and Ulmer-Scholle, D.S., eds., The Geology of the Ouray-Silverton Area, New Mexico Geological Society 68th Annual Fall Field Conference Guidebook, p. 179-186.
Potter-McIntyre, S., Boraas, M., DePriest, K., and **Aslan, A**. 2016, Middle Jurassic landscape evolution of southwest Laurentia using detrital zircon geochronology. Lithosphere. doi:10.1130/L467.1
Kimbrough, D.L., Grove, M., Gehrels, G.E., Dorsey, R.J., Howard, K.A., Lovera, O., **Aslan, A**., House, P.K., and Pearthree, P.A. 2015. Detrital zircon U-Pb provenance of the Colorado River: A 5 m.y. record of incision into cover strata overlying the Colorado Plateau and adjacent regions. Geosphere, v. 11, p. 1719-1748.
Aslan, A., Hood, W., Karlstrom, K.E., Kirby, E., Granger, D., Kelley, S., Crow, R., Donahue, M.S., Polyak, V., and Asmerom, Y. 2014. Abandonment of Unaweep Canyon (1.4 to 0.8 Ma), western Colorado: effects of stream capture on anomalously rapid Pleistocene river incison. Geosphere, v. 10, no. 3, p. 428-446.
Hood, W., **Aslan, A**., and Betton, C. 2014. Aftermath of a stream capture: Cactus Park lake spillover and the origin of East Creek, Uncompahgre Plateau, western Colorado. Geosphere, v. 10, no. 3, p. 447-461.
Rosenberg, R., Kirby, E., **Aslan, A**., Karlstrom, K.E., Heizler, M., and Ouimet, W. 2014. Late Miocene erosion and evolution of topography along the western slope of the Colorado Rockies. Geosphere, v. 10, no. 4, p. 641-663.
Lazear, G., Karlstrom, K.E., **Aslan, A**., and Kelley, S. 2013. Denudation and flexural isostatic response of the Colorado Plateau and southern Rocky Mountains region since 10 Ma, Geosphere, v. 9, no. 4, p. 792-814. http://dx.doi.org/10.1130/GES00836.1
Donahue, M.S., Karlstrom, K.E., **Aslan, A**., Darling, A., Granger, D., Wan, E., Dickinson, R., and Kirby, E. 2013. Incision history of the Black Canyon of the Gunnison, Colorado, over the past ~1 Ma inferred from dating of fluvial gravel deposits. Geosphere, v. 9, no. 4, p. 815-826. http://dx.doi.org/10.1130/GES00847.1
Karlstrom, K.E., Beard, L.S., House, K., Young, R.A., **Aslan, A**., Billingsley, G., and Pederson, J. 2012. Introduction: CRevolution 2: Origin and Evolution of the Colorado River System II. Geosphere, v. 8, no. 6, p. 1-7.
Darling, A.L.**,** Karlstrom, K.E., Granger, D.E., **Aslan, A.**, Kirby, E., Ouimet, W.B., Lazear,

G.D., Coblentz, D., and Cole, R.D. 2012. New incision rates along the Colorado River system based on cosmogenic burial dating of terraces: Implications for regional controls on Quaternary incision. Geosphere, v. 8, no. 5, p. 1020-1041.

Karlstrom, K.E., Coblentz, D., Dueker, K Ouimet, W., Kirby, E., Van Wijk, J., Schmandt, B., Kelley, S., Lazear, G., Crossey, L.J., Crow, R., **Aslan, A**., Darling, A., Aster, R., MacCarthy, J., Hansen, J., Stachnik, J., and the CREST working group. 2012. Mantle-driven dynamic uplift of the Rocky Mountains and Colorado Plateau and its surface response: toward a unified hypothesis. Lithosphere, v. 4, p. 3-22.

Aslan, A., Karlstrom, K.E., and Darling, A. 2011. Origin of the Ancestral Colorado and Gunnison Rivers and Post-10 Ma River Incision Rates in Western Colorado. In Beard, L.S., Karlstrom, K.E., Young, R.A., and Billingsley, G.H., eds., 2011, CRevolution 2—Origin and evolution of the Colorado River system, workshop abstracts: U.S. Geological Survey Open-File Report 2011–1210, 300 p., available at http://pubs.usgs.gov/of/2011/1210/.

Sandoval, M. M. Karlstrom, K.E., Darling, A., **Aslan, A**., Granger, D., Wan, E., and Noe, D., and Dickinson, R. 2011. Quaternary Inicision History of the Black Canyon of the Gunnison, Colorado. In Beard, L.S., Karlstrom, K.E., Young, R.A., and Billingsley, G.H., eds., 2011, CRevolution 2—Origin and evolution of the Colorado River system, workshop abstracts: U.S. Geological Survey Open-File Report 2011–1210, 300 p., available at http://pubs.usgs.gov/of/2011/1210/.

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Karlstrom, K., Coblentz, D., Ouimet, W., Kirby, E., Van Wijk, J., Schmandt, B., Crossey, L., Crow, R., Kelley, S., **Aslan, A**, Darling, A., Dueker, K., Aster, R., MacCarthy J., Lazear, G., and the CREST working group. 2011. Evidence from the Colorado River system for surface uplift of the Colorado Rockies and western Colorado Plateau in the last 10 Ma driven by mantle flow and buoyancy. In Beard, L.S., Karlstrom, K.E., Young, R.A., and Billingsley, G.H., eds., 2011, CRevolution 2—Origin and evolution of the Colorado River system, workshop abstracts: U.S. Geological Survey Open-File Report 2011–1210, 300 p., available at http://pubs.usgs.gov/of/2011/1210/.

Aslan, A., Karlstrom, K.E., Crossey, L.J., Kelley, S., Cole, R., Lazear, G., and Darling, A. 2010. Late Cenozoic evolution of the Colorado Rockies: Evidence for Neogene uplift and drainage integration, in Morgan, L.A., and Quane, S.L., eds., Through the Generations: Geologic and Anthropogenic Field Excursions in the Rocky Mountains from Modern to Ancient: Geological Society of America Field Guide 18, p. 21-54.

Darling, A., Karlstrom, K., **Aslan, A**., Cole, R.D., Betton, C., and Wan, E. 2009. Quaternary incision rates and drainage evolution of the Uncompahgre and Gunnison Rivers, western Colorado, as calibrated by the Lava Creek B ash. Rocky Mountain Geology, v. 44, p. 71-83.

Hood, W.C., Cole, R.D., and **Aslan, A.** 2009. Anomalous cold in the Pangaean Tropics. Geology – Comment, v. 37, p. 192.

Aslan, A., Karlstrom, K., Hood, W., Cole, R.D., Oesleby, T., Betton, C., Sandoval, M., Darling,

A., Kelley, S., Hudson, A., Kaproth, B., Schoepfer, S., Benage, M., Landman, R. 2008. River incision histories of the Black Canyon of the Gunnison and Unaweep Canyon: Interplay between late Cenozoic tectonism, climate change, and drainage integration in the western Rocky Mountains, In Raynolds, R.G. (ed.), Roaming the Rocky Mountains and Environs: Geological Society of American Field Guide 10, p. 175-202.

Aslan, A., Autin, W.J., Blum, M.D., 2006, Reply to Comment - Late Holocene Avulsion History of the Mississippi River, south Louisiana, U.S.A. Journal of Sedimentary Research, v. 76, p. 960.

Aslan, A. 2006, Fluvial Sediments. In Elias, S. (ed.), Encyclopedia of Quaternary Science. Elsevier, p. 672-685.

Blum, M.D. and **Aslan, A.** 2006, Signatures of climate vs. sea-level change: A review and look forward, Sedimentology, v. 47 (Suppl. 1), p. 2-48.

Aslan, A., Autin, W.J., Blum, M.D., 2005, Late Holocene Avulsion History of the Mississippi River, south Louisiana, U.S.A. Journal of Sedimentary Research, v. 75, p. 648-662.

Aslan, A., White, W.A., Warne, A.G., and Guevara, E.H. 2003. Holocene Evolution of the western Orinoco Delta, Venezuela. Geological Society of America Bulletin, v. 115, p. 479-498.

Aslan, A. 2003, Floodplain Sediments. In Middleton, G.V. (ed.), Encyclopedia of Sediments and Sedimentary Rocks. Encyclopedia of Earth Sciences Series, Kluwer Academic Publishers, p. 285-287.

Aslan, A. 2003, Palaeosols. In Goudie, A.G. (ed.), Encyclopedia of Geomorphology. Routledge, London.

Aslan, A. 2003, Mud volcanoes. In Goudie, A.G. (ed.), Encyclopedia of Geomorphology. Routledge, London.

White, W.A., Warne, A.G., Guevara, E.H., **Aslan, A**., Tremblay, T.A., and Raney J.A. 2002. Geo-Environments of the Northwest Orinoco Delta, Venezuela. Interciencia, v. 27. p. 521-528.

Warne, A.G., Guevara, E.H., and **Aslan, A**. 2002. Late Quaternary Evolution of the Orinoco Delta, Venezuela. Journal of Coastal Research, v. 18, p. 225-253.

Warne, A.G., Meade, R.H., White, W.A., Guevara, E.H., Gibeaut, J., Smyth, R.C., **Aslan, A.,** and Tremblay, T. 2002. Regional Controls on Geomorphology, Hydrology, and Ecosystem Integrity of the Orinoco Delta, Venezuela. Geomorphology, v. 44, p. 273-307.

Aslan, A., Warne, A.G., White, W.A., Guevara, E.H., Smyth, R.C., Raney, J.A., and Gibeaut, J.C. 2001. Mud Volcanoes of the Orinoco Delta, Eastern Venezuela. Geomorphology, v. 41, p. 323-336.

Autin, W.J. and **Aslan, A**. 2001. Alluvial Pedogenesis in Pleistocene and Holocene Mississippi River deposits: Effects of relative sea level change. Geological Society of America Bulletin, v. 113, p. 1456-1466.

Blum, M.D., Misner, T.J., Collins, E.S., Scott, D.B., Morton, R.A., and **Aslan, A**. 2001. Middle Holocene Sea-Level Rise and Highstand at +2 m, Central Texas Coast. Journal of Sedimentary Research, v. 71, p. 581-588.

Aslan, A. and Autin, W.J. 1999. Evolution of the Holocene Mississippi River Floodplain, Ferriday, Louisiana: Insights on the Origin of Fine-Grained Floodplains. Journal of Sedimentary Research, v. 69, p. 800-815.

Aslan, A. and Blum, M.D. 1999. Contrasting styles of Holocene avulsion, Texas Gulf Coastal Plain, U.S.A. In Smith, N.D. and Rogers, J., eds., Fluvial Sedimentology VI, International Association of Sedimentologists, Special Publication, v. 28, p. 293-308.

Kraus, M.J. and **Aslan, A.** 1999. Paleosol sequences in floodplain environments: a hierarchical approach. In Thiry, M., ed., Palaeoweathering, Palaeosurfaces and Related Continental Deposits, International Association of Sedimentologists, Special Publication, v. 27, p. 303-321.

Aslan, A. and Autin, W.J. 1998. Holocene Flood-plain Soil Formation in the Southern Lower Mississippi Valley: Implications for Interpreting Alluvial Paleosols. Geological Society of America Bulletin v. 110, p. 433-449.

Thewissen, J.G.M., Hussain, S.T., Arif, M., **Aslan, A.**, Madar, S.I., and Roe, L.J. 1998. New Localities of Eocene Vertebrates in Northern Pakistan and their Significance for the Origin of the Modern Orders of Mammals. In Ghaznavi, M.I., Raza, S.M., and Hasan, M.T. (eds.) Siwaliks of South Asia, Proceedings of the Third Geosas Workshop, Geological Survey of Pakistan, Islamabad, Pakistan, p. 19-34.

Aslan, A. and Autin, W.J. 1996. Depositional and pedogenic influences on the environmental geology of Holocene Mississippi River floodplain deposits near Ferriday, Louisiana. Engineering Geology, v. 45, p. 417-432.

Aslan, A. and Thewissen, J.G.M. 1996. Preliminary evaluation of paleosols and implications for interpreting vertebrate fossil assemblages, Kuldana Formation, northern Pakistan. Palaeovertebrata, v. 25, p. 261-277.

Aslan, A. and Behrensmeyer, A.K., 1996, Taphonomy and time resolution of bone assemblages in a contemporary fluvial system: The East Fork River, Wyoming. PALAIOS, v. 11, p. 411-421.

Kraus, M.J. and **Aslan, A.** 1993. Eocene hydromorphic paleosols: significance for interpreting ancient floodplain processes, Journal of Sedimentary Petrology, v. 63, p. 453-463.

Hasiotis, S., **Aslan, A.**, Bown, T.M. 1993. Origin, architecture, and paleoecology of the Early Eocene continental ichnofossil *Scaphicnium hamatum* - integration of ichnology and paleopedology. Ichnos, v. 3, p. 1-9.

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Autin, W.J. and **Aslan, A.** 1992. Late Pleistocene paleosols in the Lower Mississippi River Valley: documentation of regional base level change, GSA Abstracts with Programs, v. 24, no. 7, p. 228.

Aslan, A. and Kraus, M.J. 1990. Depositional control of chemical variations in alluvial paleosols, Willwood Fm., Bighorn Basin. GSA Abstracts with Programs, v. 22, no. 7, p. 317.

Aslan, A. 1989. Paleotopographic controls on mudstone sequence variations in the Willwood Formation, Bighorn Basin, Wyoming. GSA Abstracts with Programs, v.

21, no. 6, p. 127.
Aslan, A. and Behrensmeyer, A.K. 1987. Vertebrate taphonomy in the East Fork River, Wyoming. GSA Abstracts with Programs, v. 19, no. 7, p. 575.

CURRICULUM VITAE

Name: **GREGORY S. BAKER**

Address: Colorado Mesa University
Grand Junction, CO

Tel: 865-771-2819
Email: gbaker@coloradomesa.edu
Web: www.geoavatar.com

Education

Ph.D., Geology (Honors), "Seismic Imaging Shallower than Three Meters," The University of Kansas, Lawrence, Kansas, 1999 (Don W. Steeples, Advisor).

M.S., Geological Sciences, "An Examination of Triassic Cyclostratigraphy in the Newark Basin from Shallow Seismic Profiles and Geophysical Logs," Lehigh University, Bethlehem, Pennsylvania, 1994 (Anne S. Meltzer, Advisor).

B.S., Geological Sciences (Honors), "Paleomagnetic Evidence for Block Rotation in the Fransiscan Terrane, Point San Pedro, CA," Lehigh University, Bethlehem, Pennsylvania, 1992 (Kenneth P. Kodama, Advisor).

Professional Experience

Assoc. Professor of Geology, Dept. of Physical & Env. Sci., Colorado Mesa Univ., 2019-present
Pilot/Owner/Operator, GeoAvatar Inc., Drone Solutions, 2016-present
Adjunct Associate Professor, Geology, University of Kansas, 2017-present
Adjunct Associate Professor, Geology & Geological Engineering, South Dakota School of Mines & Technology, 2014-present
Instructor, Johnson County Community College, 2018-present
Visiting Associate Professor, Geology, University of Kansas, 2015-2016
Adjunct Associate Professor, Environmental Studies, Illinois Wesleyan University, 2014-2015
Jones/Bibee Endowed Associate Professor of Geophysics, Dept. of Earth and Planetary Sciences, University of Tennessee, 2006-2015 (Asst. Prof., 2005-2006)
Research Associate Professor, Dept. of Geology, University at Buffalo, 2005-2012
Assoc. Professor, Dept. of Geology, University at Buffalo, 2004-2005 (Asst. Prof. 1999-2004)
Technical Chair, Environmental & Engineering Geophys. Soc. conference (SAGEEP), 2011
Board of Directors, Environmental & Engineering Geophysical Society, 2007-2010
Editorial Board Member, *The Leading Edge*, 2010-2013
Associate Editor, *Journal of Geoscience Education*, 2006-2009
Associate Editor, *Geophysics*, 2001-2004
Visiting Instructor, National Science Foundation Research Experience for Undergraduates (REU) Program, Matanuska Glacier, Alaska, Summer 2000, 2001, 2002
Visiting Instructor, Dept. of Earth and Env. Sci., Lehigh Univ., Summer Sessions 1996-1999
Research Assistant, Dept. of Geology, University of Kansas, 1996-1999
Research Assistant, Dept. of Earth and Env. Sci., Lehigh University, 1995-1996
Geologist, GS-5, U.S. Geological Survey, Reston, VA, USGS/NAGT cooperative program, 1994

Funding

Pending Support

1. National Science Foundation (Co-PI; $236,215) “Collaborative Research: 50 Flipped Lessons: Curating Resources to Improve Student Learning in Introductory Geoscience Courses,” 6/1/20-5/31/22.
2. Geoscientists Without Boarders (Co-PI; $95,356) “Remote sensing assessment of potential active faulting, Himalaya,” 7/1/20-8/1/2021.

Active Support

1. No current active support. All previous projects completed.

Recent Support (2001 – present) in Reverse Chronological Order of End Date

1. U.S. Department of Energy ($412,000; Sole Investigator; UT-B 4000059241), “Multiscale investigations on the rates and mechanisms of targeted immobilization and natural attenuation of metal, radionuclide, and co-contaminants in the subsurface” Total attributed to UT: $412,000; 100% to GSBaker). Active 2/1/07-1/31/13.
2. TASC, Inc. ($292,000; PI), “Geophysical Technologies for Underground Tunnel and Facilities Detection and Characterization” (Total attributed to UT: $292,000; 50% to GSBaker). Active 1/1/10-12/31/10.
3. National Science Foundation ($81,609; PI; GEO-0704077), “OEDG Phase 1: Enhancing Diversity via Targeted Education and Outreach Through the East Tennessee Geosciences Program (ETGP)” Total attributed to UT: $81,609; 90% to GSBaker). Active 06/01/07-05/31/10.
4. U.S. Department of Agriculture ($61,080; Sole Investigator; USDA-06-JV-11221682-040), “Using Near Surface Geophysics to Understand Alluvial Fans and Meadow Complexes in the Central Great Basin” Total attributed to UT: $61,080; 100% to GSBaker). Active 08/01/03-07/30/09.
5. National Science Foundation ($604,561; PI; GEO-0119871), “Enhancing Diversity in Buffalo, New York, Area Geoscience Programs” Total attributed to UB: $604,561; 90% to GSBaker). Active 1/1/02-12/31/06.
6. National Science Foundation ($32,000; Sole Investigator; INT-0243524), “Archaeological Geophysics in Humayma, Jordan” Total attributed to UB: $32,000; 100% to GSBaker). Active 6/1/03-6/1/06.
7. Social Sciences and Humanities Research Council of Canada ($230,752; Project Director), “Excavation and study of the Roman fort, bath, and associated settlement at Hawara (modern Humayma), Jordan” Total attributed to UB: $0 (Research expenses paid by PI through the University of British Columbia); 0% to GSBaker. Active 5/1/02-9/1/06.
8. The Taggert Foundation (Private) ($10,332; Sole Investigator), “Excavation and study of the Roman fort, bath, and associated settlement at Hawara (modern Humayma), Jordan” Total

attributed to UB: $10,332; 100% to GSBaker. Active 5/1/02-9/1/06. (Used to cover student salary not covered through the SSHRC grant.)

9. University of Tennessee College of Arts & Sciences Instructional Equipment Grant ($10,000, PI), "Acquisition of Ground Conductivity Equipment" Total attributed to UT: $10,000; 100% to GSBaker). Active 1/1/06-6/1/06.
10. U.S. Department of Agriculture, Forest Service ($20,080; Sole Investigator), "Phase 2: Using Near Surface Geophysics to Understand Alluvial Fans and Meadow Complexes in the Central Great Basin" Total attributed to UT: $20,080; 100% to GSBaker). Active 12/31/05-12/31/06.
11. U.S. Department of Defense ($233,833; Sole Investigator; DACA42-01-C-0051), "Using Near-Surface Seismic Techniques for Improved Environmental Site Characterization" Total attributed to UB: $233,833; 100% to GSBaker). Active 10/20/01-10/19/06.
12. National Science Foundation ($118,443; Co-PI; GEO-0207720), "Integrating Hydraulic, Tracer, and Geophysical Methods to Image Flow-Channeling Behavior in Fractured Bedrock" Total attributed to UB: $118,443; 50% to GSBaker). Active 8/1/02-7/31/05.
13. U.S. Department of Agriculture, Forest Service ($61,170; Sole Investigator), "Phase 1: Using High Resolution Seismic Data to Understand Alluvial Fans and Meadow Complexes in the Central Great Basin" Total attributed to UB: $61,170; 100% to GSBaker). Active 6/1/03-5/31/06.
14. National Science Foundation ($38,529; Sole Investigator), "Acquisition of Equipment for Investigating Coincident Seismic and GPR Imaging" Total attributed to UB: $38,529; 100% to GSBaker. Active 8/1/00-7/31/02.
15. National Science Foundation TEA Supplement ($10,100; Sole Investigator), "Geophysical Investigations of Ice Flow Velocities on the Matanuska Glacier" Total attributed to UB: $10,100; 100% to GSBaker). Active 6/1/02-7/31/03.
16. National Science Foundation TEA Supplement ($10,100; Sole Investigator), "Geophysical Investigations on the Matanuska Glacier" Total attributed to UB: $10,100; 100% to GSBaker. Active 6/1/01-7/31/02.
17. Seismic Mocro-Technology (SMT), Inc. ($495,161; Sole Investigator), Software grant for 16 licenses of KINGDOM Suite+ including annual maintenance fee. Total attributed to UB: $495,161; 100% to GSBaker). Active 8/1/03-8/1/06.
18. Environment and Society Institute (Univ. at Buffalo) Environmental Management Alternatives Program ($19,900; Principal Investigator), "Integrated geophysical, geochemical, and structural site characterization near the West Valley Demonstration Project" Total attributed to UB: $19,900; 60% to GSBaker. Active 9/1/2000-10/30/01.
19. University at Buffalo Environmental Management Alternatives Program (EMAP) ($21,793; Principal Investigator), "Integrated Geophysical, Geochemical, and Structural Site Characterization Near the West Valley Demonstration Project" Total attributed to UB: $21,793; 50% to GSBaker. Active 10/1/00-12/30/01.
20. University at Buffalo Pilot Program $21,793; Principal Investigator), "Direct detection of nonaqueous-phase liquid contaminants using amplitude-variation-with-offset analysis on ground penetrating radar data" Total attributed to UB: $15,000; 60% to GSBaker. Active 8/1/2000-10/30/01.
21. University at Buffalo Faculty Educational Technology Development Grant ($8,988, Co-PI), "Hydrogeophyisical monitoring at the Duttweiller Property" Total attributed to UB: $8,988; 50% to GSBaker). Active 6/1/02-9/30/03.

22. U.S. Coast Guard Support Center, Elizabeth City, North Carolina ($2,756: co-PI), "Field testing APVO analysis of GPR data across a site containing an extensive jet propellant release" Active 6/1/02-12/31/02.
23. U.S. Department of Defense, Mayport, Florida ($5,955: co-PI), "Field testing APVO analysis of GPR data across a site containing an extensive diesel fuel release" Active 6/1/02-12/31/02.
24. U.S. Department of Defense, Fort Drum, New York ($450: Sole Investigator), "Examination of APVO analysis of GPR data for delineation of an extensive gasoline release in sandy soils, Fort Drum, New York" Total attributed to UB: $450; 100% to GSBaker. Active 8/20/01-12/31/02.

Publications

PUBLICATION DATA

ORCID: 0000-0003-4184-8000
SCOPUS AUTHOR ID: 36764687100
CURRENT H-INDEX ESTIMATES: 21 (Google Scholar); 18 (ResearchGate); 16 (Scopus)
CURRENT i10 INDEX ESTIMATES: 29 (Google Scholar)
TOTAL CITATIONS ESTIMATES: 1391 (Google Scholar); 1051 (ResearchGate); 760 (Scopus)
TOTAL READs ESTIMATE: 25,260 (ResearchGate)
RG SCORE ESTIMATE: 26.30 (ResearchGate)
RESEARCH ITEMS: 161 (Google Scholar); 117 (ResearchGate); 68 (Scopus)

Books, Monographs, Edited Volumes (* denoted supervised student)

1. **Baker**, G.S., and Jol, H.J., eds., 2007, Stratigraphic Analysis using Ground Penetrating Radar: Geological Society of America, *Special Paper 432*. [ISBN 978-0-8137-2432-4]
2. **Baker**, G.S., *Jordan, T.J., and Collins, S., 2003, Laboratory manual for global environmental science, 3rd Edition: Wiley & Sons, Inc., 254 p. [ISBN 0-471-54122-2]
3. **Baker**, G.S., *Jordan, T.J., and Collins, S., 2002, Laboratory manual for global environmental science, 2nd Edition: Wiley & Sons, Inc., 232 p. [ISBN 0-471-39138-2]
4. **Baker**, G.S., and Collins, S., 2001, Laboratory manual for global environmental science: Wiley & Sons, Inc., 216. [ISBN 0-471-20180-4]
5. **Baker**, G.S., 1999, Processing near-surface seismic-reflection data: A Primer: edited by R.A. Young, *Society of Exploration Geophysicists Publications*. [ISBN 1-56080-090-9]

Refereed Journal Articles (* denoted supervised student) in Chronological Order

Published

First-Authored Publications

1. **Baker**, G.S., 2008, Improving our understanding of near-surface seismic reflection data

quality: Invited contribution to *The Leading Edge* Special Issue, 27, 1526-1534.

2. **Baker**, G.S., *Jordan, T.E., and *Talley, J., 2007, An introduction to ground penetrating radar (GPR), *in* Baker, G.S., and Jol, H.M., eds., Stratigraphic Analyses Using GPR: *Geological Society of America Special Paper 432*, 1–18.
3. **Baker**, G.S., Strasser, J.C., Evenson, E.B., Lawson, D.E., Pyke, K.P., and Bigl, R.A., 2003, Near-surface seismic reflection profiling of the Matanuska Glacier, Alaska USA: *Geophysics*, *68*, no 1, 147-156.
4. **Baker**, G.S., Steeples, D.W., and Schmeissner, C, 2002, The effect of seasonal soil-moisture conditions on near-surface seismic reflection data quality: *First Break, 20,* no 1, 35-41.
5. **Baker**, G.S., Steeples, D.W., Schmeissner, C., Pavlovic, M., and Plumb, R., 2001, Coincident imaging with seismic and GPR techniques: *Geophys. Res. Lett.*, *28*, no 4, 627-630.
6. **Baker**, G.S., Steeples, D.W., Schmeissner, C., and Spikes, K.T., 2000, Source-dependent frequency content of ultrashallow seismic reflection data: *Bull. Seis. Soc. Amer*., *90*, 2, 494-499.
7. **Baker**, G.S., Steeples, D.W., Schmeissner, C., and Spikes, K.T., 2000, Ultrashallow Seismic Reflection Monitoring of Seasonal Fluctuations in the Water Table: *Environmental and Engineering Geoscience*, *6*, no 3, 271-277.
8. **Baker**, G.S., Schmeissner, C., Steeples, D.W., and Plumb, R.G., 1999, Seismic reflections from depths of less than two meters: *Geophys. Res. Lett.*, *26* , no 2, 279-282.
9. **Baker**, G.S., Steeples, D.W., and Schmeissner, C., 1999, In situ, high-resolution P-wave velocity measurements within 1 m of the Earth's surface: *Geophysics*, *64*, no 2, 323-325.
10. **Baker**, G.S., 1998, Applying AVO analysis to GPR data: *Geophys. Res. Lett.*, *25*, no 3, 397-400.
11. **Baker**, G.S., Steeples, D.W., and Drake, M., 1998, Muting the noise cone in near-surface reflection data: an example from southeastern Kansas: *Geophysics*, *63*, no 4, 1332-1338.
12. **Baker**, G.S., Steeples, D.W., and Feroci, M., 1997, The time dependence of shallow reflection data: *The Leading Edge*, *16*, no 11, 1663-1666.

Supervised-Student Authored Publications

1. *Williams, C.M., **Baker**, G.S., and Ault, B.A., 2012, Enhancing usability of near-surface geophysical data in archaeological surveys via Google Earth, *in* Whitmeyer, S.J., Bailey, J.E., De Paor, D.G., and Ornduff, T., eds., Google Earth and Virtual Visualizations in Geoscience Education and Research: Geological Society of America Special Paper 492, p. 55–68, , doi:10.1130/2012.2492(04).
2. *Gaines, D.P., **Baker**, G.S., Hubbard, S.S., Watson, D, Brooks, S., and Jardine, P., 2010, Detecting perched water bodies using near-surface seismic time-lapse travel-time tomography, *in* Miller, R.D., Bradford J,H, Holliger, K., eds., *Advances in Near Surface Seismology and Ground-Penetrating Radar*, Society of Exploration Geophysicists, Tulsa, OK, ISBN 9781560802242.
3. *Evenick, J.C., Hatcher, R.D., **Baker**, G.S., 2008, Trend surface residual anomaly mapping and well data may be underutilized combo: *Oil & Gas Journal*, Jan. 2008, 35-42.
4. *Gilcrist, L.E., **Baker**, G.S., Sen S., 2007, Preferred frequencies for three unconsolidated Earth materials: *Applied Physics Letters*, 91, 254-257.

5. *Stokes, P.J., **Baker**, G.S., Briner, J.P., and Dorsey, D.J., 2007, Multifaceted outreach model for enhancing diversity in the geosciences in Buffalo, NY: *Journal of Geoscience Education*, v. 55, n. 6, p. 574-580.
6. *Bennett, G., Weissmann, G.S., **Baker**, G.S., and Hyndman, D.W., 2006, Regional-scale assessment of a sequence bounding paleosol on fluvial fans using ground penetrating radar, eastern San Joaquin Valley, California: *Geological Society of America Bulletin*, v. 118, p. no 5, 724-732.
7. *Evenick, J. C., Jacobi, R. D., **Baker**, G. S., and Mitchell, C. E., 2005, Subsurface evidence for faults in the Appalachian basin, western New York State: *Northeastern Geology and Environmental Sciences*, v. 27, no. 1, p. 1-17.
8. *Talley, J., **Baker**, G.S., Becker, M.W., Beyrle, K., 2005, Four Dimensional Mapping of Tracer Channelization in Sub-Horizontal Bedrock Fractures using Surface Ground Penetrating Radar, *Geophysical Research Letters*, v. 32, p. 732-735.
9. *Jordan, T.E. and **Baker**, G.S., 2004, Amplitude and Phase Variation with Offset (APVO) Analysis of Ground Penetrating Radar Data: Theory and Forward Modeling: *Envorinmental and Engineering Geoscience*.
10. *Jordan, T.E., **Baker**, G.S., Henn, K., Messier, J-P., 2004, Using amplitude variation with offset and normalized residual polarization analysis of ground penetrating radar data to differentiate an NAPL release from stratigraphic changes: *Journal of Applied Geophysics, 56*, 41– 58.
11. *Jordan, T.W., and **Baker**, G.S., 2003, Recommendation for new terminology for linear polarized components of ground penetrating radar waves: *Journal of Environmental and Engineering Geophysics*., 8, no 1, 39-42.
12. *Malinowski, M., and **Baker**, G.S., 2003, Experimental results of energy and soil-moisture effects on nonlinear deformation associated with near-surface seismic reflection sources: *Journal of Environmental and Engineering Geophysics, 8*, no 4, 221-226.

Other Peer-Reviewed Publications

1. Roberts, J. A., **Baker**, G. S., McLean, N., Moeller, A., & Olcott Marshall, A., 2018, Impact of Classroom Transformation on Inequality in DFW Rates ("D" or "F" grade or Withdraw) for Women and Underrepresented Minorities in an Introductory Geology Course. *Journal of Geoscience Education*, v 66, issue 4, 304-318.
2. Gasperikova, E., S.S. Hubbard, G.S. **Baker**, and D. Watson, 2013, Long-term monitoring of recharge induced contaminant plume behavior: *Journal of Contaminant Hydrology*.
3. Kowalsky, M. B., E. Gasperikova, S. Finsterle, D. Watson, G. **Baker**, and S. S. Hubbard, 2011, Coupled modeling of hydrogeochemical and electrical resistivity data for exploring the impact of recharge on subsurface contamination, *Water Resour. Res*., 47, W02509, doi:10.1029/2009WR008947.
4. Sherwood, A.W., Oleson, J.P., de Bruijn, E., Bevan, G., **Baker**, G., and *Ambrose, H., 2008, Preliminary report of the Humayma Excavation Project, 2002, 2004-2005: The Roman Fort, Part I: Geophysical Surveys, Praetorium and Horreum: Mouseion (Journal of the Classical Association of Canada), Series III, Vol. 8, No. 2., 119-158.
5. Alley, R.B., Lawson, D.E., Larson, G.J., Evenson, E.B., and **Baker**, G.S., 2003, Stabilizing feedbacks in glacier-bed erosion: *Nature, 424*, 758-760.
6. Black, R.A., Walker, J.D., and **Baker**, G.S., 2002, Three-dimensional gravity modeling and

crustal-density variations, Panamint Range to the eastern Sierra Nevada, southeastern California, *in* Glazner, A.F., Walker, J.D., and Bartly, J.M., eds., Geologic Evolution of the Mojave Desert and Southwestern Basin and Range: Boulder, Colorado, *Geological Society of America Memoir 195*, p. 229-241.

7. Steeples, D.W., **Baker**, G.S., and Schmeissner, C., 1999, Toward the autojuggie: Planting 72 geophones in 2 seconds: *Geophys. Res. Lett., 26* , no 8 , 1085-1088.
8. Steeples, D.W., **Baker**, G.S., Schmeissner, C., and Macy, B.K., 1999, Geophones on a Board: *Geophysics, 64*, no 3, 809-814.

Nonrefereed Publications (* denoted supervised student) in Chronological Order

1. **Baker**, G.S., 2012, *Book Review:* Advances in Near-Surface Seismology and Ground-Penetrating Radar, Richard D. Miller, John H. Bradford, and Klaus Holliger (Eds.): *Vadose Zone Journal*.
2. Miller, R. and **Baker**, G.S., 2011, Introduction to special issue: Near-surface geophysics*: The Leading Edge*, 30, no 2. *in* Miller and Baker, special eds., Near-Surface Geophysics special issue.
3. Young, R. A., and **Baker**, G.S., 2005, Introduction of Special Issue on Near Surface Geophysics University Research and Education: Invited contribution in *FastTIMES*: Newsmagazine for the near surface geophysical sciences, Young and Baker., Special Eds., *9*, no 9.
4. **Baker**, G.S., 2004, The Near Surface Geophysics (NSG) section of the Society of Exploration Geophysicists: Invited contribution in *FastTIMES*: Newsmagazine for the near surface geophysical sciences, Doll, W.E., Special dd., *9*, no 9.
5. Kopczynski, S.E., S.R. Bigl, J.V. Holmes, D.C. Finnegan, G.S. **Baker**, A. Delaney. September 2003. Hydrogeology of the Poleline Road Disposal Area . CRREL Contract Report. Prepared for U.S. Army Alaska, Directorate of Public Works.
6. Larson,G.J., Evenson, E.B., Lawson, D.E., Ensminger, S.L., **Baker**, G.S., and Alley, R.B., 2003, Glacial Geology of Upper Cook Inlet, Matanuska Glacier and Denali Highway: *in* Easterbrook, D.J., ed., Field Trip Guide, The XVI INQUA Congress (International Union for Quaternary Research).
7. *Mayer, C.M., and **Baker**, G.S., 2003, Methods of Rapid Azimuthal Resistivity Collection with an Ohmmapper Resistivity Meter: *University at Buffalo Journal of Undergraduate Research, 1*, A 1-6.
8. *Talley. J., *McEwan, D., *Shaffer, W. and G. S. **Baker**, 2003, The Rensch Canal Project: *University at Buffalo Journal of Undergraduate Research, 1*, B 1-14.
9. **Baker**, G.S., 2002, Book review of "Surviving Galeras" by Stanley Williams and Fen Montaigne: Cambridge Press, *in* Science, Books & Films: American Association for the Advancement of Science, vol 38, no 4, p 460-461.
10. Oleson, J.P., **Baker**, G.S., Sherwood, A.N., deBruijn, E., Reeves M.B., Ambrose H.M., 2002, Report on the Humayma Excavation Project for 2002: Unpublished Report Submitted to the Jordanian Department of Antiquities.
11. **Baker**, G.S., 2001, Book review of "Fore in the Sea—The Santorini Volcano: Natural History and the Legend of Atlantis" by Walter L. Friedrich: Cambridge Press, *in* Science, Books & Films: American Association for the Advancement of Science, vol 37, no 1, p 17-18.

12. **Baker**, G.S., 2000, Book review of "Earth Almanac: An annual geophysical review of the state of the planet" by Natalie Goldstein: Oryx Press, *in* Science, Books & Films: American Association for the Advancement of Science, vol 36, no 5, p 216.
13. **Baker**, G.S., 2000, Matanuska Glacier July 2000 Preliminary Geophysics Report: Cold Regions Research and Engineering Laboratory (CRREL) report, 16 p.
14. **Baker**, G.S., 1999, Seismic Imaging Shallower than Three Meters: PhD (Honors) dissertation, The University of Kansas, 320 p.
15. **Baker**, G.S., Steeples, D.W., and Schmeissner, C., 1998, New views on the shallow subsurface: Near-surface views, Near-surface geophysics section of the Soc. Expl. Geoph. newsletter, October, 1998.
16. Steeples, D.W., and **Baker**, G.S., 1998, Finding seismic static corrections: *AAPG Explorer*, *19*, no 6, 20-21,29.
17. **Baker**, G.S., 1994, An Examination of Triassic Cyclostratigraphy in the Newark Basin from Shallow Seismic Profiles and Geophysical Logs: M.Sc. thesis, Lehigh University, 186 p.
18. **Baker**, G.S., 1992, Paleomagnetic Evidence for Block Rotation in the Fransiscan Terrane, Point San Pedro, CA: B.S. (Honors) Thesis, Lehigh University, 112 p.
19. **Baker**, G.S., Cherichetti, P., Cyr, K., DeVivo, J., Gascoyne, R., Gatti, J.A., Kinney, D., Peper, E., Rohrer, J., and Warner, L., 1991, Lehigh University Campus Soils: A Preliminary Sedimentologic Study: Contribution 001 of *Campus Environmental Studies Series*, Lehigh University, 25p.

Conference Proceedings in Chronological Order

Invited Abstracts (denoted supervised student)*

1. Roberts, J. A., and **Baker**, G. S. Flipping Your Class: What to Take Out, What to Leave In, 2016 (invited), Earth Educators Rendezvous, Madison WI.
2. Hubbard, S.S., **Baker**, G.S., Kowalsky, M.B., Chen, J., Gasperikova , E., *Gaines, D.P., *Smith, M., Watson, D., and Brooks, S., 2010, Hydrogeophysical Quantification of Plume-Scale Subsurface Architecture and Recharge Processes: 5th Annual ERSP Meeting, March 29-31, 2010.
3. W-M. Wu, D. Watson, T. Mehlhorn, J. Earles, M. Boyanov, T. M. Gihring, G. Zhang, C. Schadt, K. Lowe, J. Phillips, K.M. Kemner, B. Spalding, Y. Wu, S. Hubbard, G. **Baker**, C.S. Criddle, P.M. Jardine, S. Books, 2010, In situ Biostimulation of Uranium Reduction and Immobilization Using Emulsified Vegetable Oil as Electron Donor at the Oak Ridge IFRC Site: 5th Annual ERSP Meeting, March 29-31, 2010.
4. Evenson, E.B., Gosse, J., **Baker**, G.S., Burkhart, P., Jackofski, D.S., Meglioli, A., 2009, The giant bounder trains of Tierra Del Fuego and the origin of "Darwin's Boulders": Geological Society of America *Abstracts with Programs*, Vol. 41, No. 7, p. 244.
5. Hubbard, S.S., **Baker**, G.S., Chen, J., Kowalsky, M., Gasperikova, E., *Gaines, D.P., *Modi, A., Jardine, P.W., 2009, Hydrogeophysical Quantification of Plume-Scale Flow Architecture and Recharge Processes at the ORNL IFRC: US Dept. of Energy Environmental Sciences Remediation Program Principal Investigators Meeting, Lansdown VA, April 2009.
6. **Baker**, G.S., *Pyke, K.P., Evenson, E.B., Lawson, D., Larson, G., and Alley, R.B., 2005, Application of Near-Surface Geophysics to Problems in Glacier Dynamics, Pitted Outwash

Plain Formation, and Glaciotectonics, Matanuska Glacier, Alaska: *Eos, Transactions, American Geophysical Union*, Spring Meeting.

Abstracts Resulting in Awards (denoted supervised student)*

1. *Best Paper:* *Sturtevant, K.A., **Baker**, G.S., Lord, M., Miller, J., Jewitt, D., Germanoski, D., Chambers, J., 2006, Combining multiple seismic and ground penetrating radar techniques to analyze hydrologic controls on riparian meadow complexes in the Central Great Basin, Nevada USA: *Symposium on the Application of Geophysics to Engineering & Environmental Problems*.
2. *Best Paper, Honorable Mention:* **Baker**, G., Steeples, D. and Schmeissner, C., 1999, On coincident seismic and radar imaging, *Society of Exploration Geophysicists 1999 International Exposition and 69th Annual Meeting*, Houston TX.

First-Authored, Peer-Reviewed Expanded Abstracts (denoted supervised student)*

1. **Baker**, G.S., *Gaines, D.P., Hubbard, S.S., Watson, D., Brooks, S., 2010, Detecting perched water bodies using surface seismic time-lapse travel-time tomography: Expanded Abstract, European Assiciation of Geoscientists & Engineers—Near-Surface Geophysics, Zurich, Switzerland.
2. **Baker**, G.S., and *Ambrose, H.M., 2005, Quantitatively merging GPR and magnetic gradiometry data for enhanced interpretation of archaeological geophysics surveys: *Society of Exploration Geophysicists 2005 International Exposition and 75th Annual Meeting*, Houston, Texas.
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9. Lord, M.L., Jewett, D.G., Miller, J.R., Germanowski, D., **Baker**, G.S., and Chambers, J.C., 2005, Hydrogeomorphic setting, characteristics, and response to stream incision of montane riparian meadows in the Central Great Basin—Implications for restoration: *Geological Society of America Abstracts with Programs*, Vol. 37, No. 7, p. 538.
10. Germanuwski, D., Miller, J.R., Lord, M.L., Jewett, D.G., Chambers, J.C., **Baker**, G.S., and Bergman, J., 2005, Reach specific channel stabilization based on comprehensive evaluation of valley fill history, alluvial architecture and groundwater hydrology in a mountain stream in the Central Great Basin, Nevada: *Geological Society of America Abstracts with Programs*, Vol. 37, No. 7, p. 538.
11. Trowbridge, W.B., Germanowski, D., Lord M.L., Jewett, D.G., **Baker**, G.S., and Chambers, J.C., 2005, An interdisciplinary approach to riparian meadow characterization and prioritization, Central Great Basin: *Geological Society of America Abstracts with Programs*, Vol. 37, No. 7, p. 538.
12. Becker, M.W., J. *Talley, G.S. **Baker**, N. *Beyrle, 2004, Flow-Channeling in Fractured Bedrock: Combining GPR, Tracer, and Hydraulic Data, *American Geophysical Union National Fall Meeting*, December 12-17, 2004.
13. Romanowicz, E.A., Paillet, F., Reeve, A., Becker, M.W., **Baker**, G.S., Franzi, D., 2004, Characterizing the Hydraulic Properties of Fractured Bedrock: A Fractured Sandstone Example: *National Ground Water Association / U.S Environmental Protection Agency Fractured Rock Conference*, Burlington, Vermont.
14. Snyder, C.F., G.B.**Baker**, S.Pack, S.E. Kopczynski, and K. Sturtevant, 2004, Partial Derivative Modeling of Shallow Seismic Refraction Tomography Data, Birch Hill Tank Farm, Fort Wainwright, Fairbanks, Alaska: *Eos, Transactions, American Geophysical Union.*
15. Kopczynski S.E., Bigl, R., **Baker**, G.S., Delaney A.J., Finnegan, D.C., Holmes J.V., Andrews, J.L., 2003, Integrated approach to three-dimensionally modeling an aquifer in Alaska: *Geological Society of America Abstracts with Programs*, *35*, no 7, 76.
16. Kopczynski S.E., Snyder, C.F., Myse, T.A., **Baker**, G.S., Bigl, S.R., Finnegan, D.C., Delaney, A.J., and Holmes, J.V., 2003, Coupling near-surface geophysics with three-dimentional geological model building for environmental investigations: *Eos, Transactions, American Geophysical Union*.

17. Astley, B.N., Delaney, A., Bigl, S.R., Snyder, C.F., Lawson, D.E., and **Baker**, G.S., 2000, Combining geophysical techniques for hydrogeologic modeling at Fort Richardson, Alaska: *GSA Abstracts with Programs*, Vol. 32, No. 7.
18. *McIntyre, C., *Walczak, L., and **Baker** G.S., 2000, Swept-frequency acoustic seismic source: Sigma Xi Research Competition (Univ. at Buffalo Chapter) poster presentation, April 25, 2000.
19. Steeples, D.W., Schmeissner, C.M., and **Baker**, G.S., 2000, Applications of and recent developments in shallow seismic reflection: Abstract, SSA 95th Annual Meeting, April 10-12, San Diego, CA, in Seismological Research Letters, vol. 71, no. 2, March/April, p. 231.
20. Stephens, G.C., Starrs, J.E., and **Baker**, G.S., 1999, Results of the Geological and Geophysical Investigations of the Harewood Cemetery, Charles Town, West Virginia - a Cautionary Tale: American Academy of Forensic Sciences Annual Meeting.
21. Evenson, E.B., Myers, P.B., Stephens, G.C., Anastasio, D.J., Bebout, G.E., and **Baker**, G.S., 1998, Sharing the field camp experience with your undergraduates, opportunities for student/faculty group participation: The Lehigh cooperative model: Geol. Soc. Amer., Abs. with Programs, vol 30, no 7.
22. Steeples, D.W., **Baker**, G.S., and Schmeissner, C., 1998, Toward the autojuggie: Planting 72 geophones in 2 seconds: Eos, Transactions, American Geophysical Union, Nov. 10.
23. Steeples, D. W., **Baker**, G. S., Schmeissner, C. M. and Macy, B. K., 1998, Geophones on a board, 68th Ann. Internat. Mtg: Soc. of Expl. Geophys., 862-865.
24. Clement, W.P., **Baker**, G., Weedman, A., Atkins, J., and Smithson, S.B., 1995, Near surface geophysics in the Northern Rock Mountains: Eos, Transactions, American Geophysical Union, vol 76, no 46, 417-418.

Professional Service

Short Courses/Workshops

1. "Introduction to drones (sUAS) in the geosciences," 2019, Short Course, Geological Society of America Annual Meeting, Phoenix Arizona, September 2019.
2. "FAA Part 107 Remote Pilot Certificate Test Preparation" 2019, Short Course, Johnson County Community College, KS, February 2019.
3. "Introduction to drones (sUAS) in the geosciences," 2018, Short Course, Geological Society of America Annual Meeting, Indianapolis Indiana, November 2018.
4. "FAA Part 107 Remote Pilot Certificate Test Preparation" 2017, Short Course, Johnson County Community College, KS, December 2018.
5. "Introduction to small unmanned aerial systems ("drones") and associated applications in STEM explorations," Workshop, 2018 Earth Educators Rendezvous, Lawrence KS, July 2018.
6. "FAA Part 107 Remote Pilot Certificate Test Preparation" 2017, Short Course, Johnson County Community College, KS, May 2018.
7. "Adopting flipped classroom strategies to enhance active learning in college classrooms," Workshop, 2017 Earth Educators Rendezvous, Albuquerque, New Mexico, July 2017.

8. “Introduction to Near-Surface Geophysics for Non-geophysicists” Short Course, Geological Society of America Annual Meeting, Baltimore MD, November 2015.
9. “Introduction to Near-Surface Geophysics for Non-geophysicists” Short Course, Geological Society of America Annual Meeting, Vancouver Canada, November 2014.
10. “Introduction to Near-Surface Geophysics for Non-geophysicists” Short Course, Geological Society of America Annual Meeting, Denver CO, November 2013.
11. “Introduction to Near-Surface Geophysics for Non-geophysicists” Short Course, Cutting Edge Workshop on Teaching Structural Geology, Geophysics, and Tectonics in the 21st Century, Knoxville Tennessee, August 2012.
12. “Introduction to Near-Surface Geophysics for Non-geophysicists” Short Course, Geological Society of America Annual Meeting, Charlotte NC, November 2012.
13. “Introduction to Near-Surface Geophysics for Non-geophysicists” Short Course, Geological Society of America Annual Meeting, Minneapolis MN, November 2011.
14. “Introduction to Near-Surface Geophysics for Non-geophysicists” Short Course, Geological Society of America Annual Meeting, Denver CO, October 2010.
15. “Geophysics for Water Resources and Contaminants” Short Course, Environmental and Engineering Geophysical Society, Fort Worth TX, March 2009.
16. “Geophysics for Water Resources and Contaminants” Short Course, Environmental and Engineering Geophysical Society, Philadelphia PA, April 2008.
17. “Near-Surface Seismology” Short Course, Society of Exploration Geophysicists (SEG) Education Week Short Course, Houston TX, May 2008.
18. “Near-Surface Seismology” Short Course, Society of Exploration Geophysicists (SEG) Education Week Short Course, Calgary, Canada, April 2007.
19. “Near-Surface Seismic Reflection Data Acquisition & Processing” Workshop, Department of Geology and Geophysics, Texas A & M, invited workshop, College Station, TX, April 2006.
20. “Near-Surface Seismic Reflection Data Processing” Workshop, Incorporated Research Institutions for Seismology (IRIS), invited workshop, Jackson Hole, WY, June 2001.

Technical Program Chair

1. Symposium on the Application of Geophysics to Engineering & Environmental Problems (SAGEEP), International meeting of the Environmental & Engineering Geophysical Society, Charleston SC, 2011.

Technical Program Committee Member

1. Society of Exploration Geophysicists, 74th Annual Meeting, Denver, CO, 2004.
2. Society of Exploration Geophysicists, 73rd Annual Meeting, Dallas, TX, 2003.
3. Society of Exploration Geophysicists, 72nd Annual Meeting, Salt Lake City, UT, 2002.

Professional Meeting Session Advocate/Convener

1. *Savor the Cryosphere*, Society of America 2015 Annual Meeting, Baltimore MD.
2. *Practical Faculty-Related Issues Associated with Classroom Transformation*, Society of America 2015 Annual Meeting, Baltimore MD.
3. *Utilizing 2D and 3-D Near-Surface Geophysics to Generate Improved Surface and Subsurface Geologic Maps*, Society of America 2015 Annual Meeting, Baltimore MD.
4. *In the footsteps of Darwin the geologist: Celebrating Darwin's 200th birthday*, Pardee session at the Geological Society of America 2009 Annual Meeting, Portland Oregon.
5. *Multitool Data Fusion*, Society of Exploration Geophysicists, 76th Annual Meeting, New Orleans, Louisiana.
6. *Hydrogeophysics*, Society of Exploration Geophysicists, 76th Annual Meeting, New Orleans, Louisiana.
7. *Seismic Reflection Acquisition and Processing*, Society of Exploration Geophysicists, 76th Annual Meeting, New Orleans, Louisiana.
8. *Multitool Data Fusion*, Society of Exploration Geophysicists, 74th Annual Meeting, Denver, Colorado.
9. *Hydrogeophysical Investigations*, Society of Exploration Geophysicists, 74th Annual Meeting, Denver, Colorado.
10. *Seismic Acquisition and Processing*, Society of Exploration Geophysicists, 74th Annual Meeting, Denver, Colorado.
11. *Experimental Geophysics*, Society of Exploration Geophysicists, 74th Annual Meeting, Denver, Colorado.
12. *Recent Advances in Hydrogeophysics*, Geological Association of Canada, the Mineralogical Association of Canada 2004 Annual Meeting, St. Catharines, ON, Canada.
13. *Advances in Stratigraphic Analyses Using Ground Penetrating Radar*, Geological Society of America 2003 Annual Meeting, Seattle, Washington.
14. *Seismic and GPR*, Society of Exploration Geophysicists, 73rd Annual Meeting, Salt Lake City, UT, 2003
15. *New Directions in Near-Surface Geophysics*, Society of Exploration Geophysicists, 73rd Annual Meeting, Salt Lake City, UT, 2003
16. *Geophysical Evaluation of Aquifer Properties*, Geological Society of America 2002 Annual Meeting, Denver, Colorado.
17. *Field Camp Pedagogies: Adjusting to Modern Equipment and the Modern Student*, Geological Society of America 1998 Annual Meeting.

Professional Meeting Session Chairman/Co-Chairman

1. *Savor the Cryosphere*, Society of America 2015 Annual Meeting, Baltimore MD.
2. *Practical Faculty-Related Issues Associated with Classroom Transformation*, Society of America 2015 Annual Meeting, Baltimore MD.
3. *Utilizing 2D and 3-D Near-Surface Geophysics to Generate Improved Surface and Subsurface Geologic Maps*, Society of America 2015 Annual Meeting, Baltimore MD.
4. *In the footsteps of Darwin the geologist: Celebrating Darwin's 200th birthday*, Pardee session at the Geological Society of America 2009 Annual Meeting, Portland Oregon.

5. *Hydrogeophysical Investigations*, Society of Exploration Geophysicists, 74th Annual Meeting, Denver, Colorado.
6. *Hydrogeology II: Process Investigations,* Geological Society of America 2004 Annual Meeting, Denver, Colorado
7. *Advances in Stratigraphic Analyses Using Ground Penetrating Radar,* Geological Society of America 2003 Annual Meeting, Seattle, Washington.
8. *Seismic and GPR*, Society of Exploration Geophysicists, 72nd Annual Meeting, Salt Lake City, UT, 2003
9. *Geophysical Evaluation of Aquifer Properties,* Geological Society of America 2002 Annual Meeting, Denver, Colorado.
10. *Influence of Soil Properties on Near Surface Geophysical Measurements,* Society of Exploration Geophysicists 1999 International Exposition and 69th Annual Meeting.
11. *Field Camp Pedagogies: Adjusting to Modern Equipment and the Modern Student,* Geological Society of America 1998 Annual Meeting.
12. *Glaciology*, Seventh International Conference on Ground-Penetrating Radar, 1998.
13. *Shallow Marine Geophysics*, Society of Exploration Geophysicists 1998 International Exposition and 68th Annual Meeting.

Organizational Memberships and Offices Held

1. American Geophysical Union, Member, 1994-present
2. Environmental and Engineering Geophysics Society
   Member, 1998-present
   Member At Large, Board of Directors, 2006-2010
3. Geological Society of America, Member, 1993-present
4. National Association of Geoscience Teachers (NAGT), Member, 1999-present
   Member, NAGT/USGS/AASG cooperative group, 2003-2010
5. NSCOMM, Inter-Society Committee for the Advancement of Near-Surface Geophysics. Composed of Rosemary Knight-Stanford Univ, Jeff Daniels-Ohio State Univ; Louise Pellerin-European SEG representative; Jeff Wynn-US Geological Survey and 2002 president of the EEGS society; Susan Hubbard-Lawrence Berkley Nat'l Lab; Pat Berge-Lawrence Livermore Nat'l Lab, and Gregory S Baker EEGS reprsentative
6. Sigma Xi (Full Member), 2000-present
7. Society of Exploration Geophysicists: Elected Active Member 1999-present
   Past-President of Near-Surface Geophysics Section of SEG, 2004-2005
   President of Near-Surface Geophysics Section of SEG, 2003-2004
   President-Elect of Near-Surface Geophysics Section of SEG, 2002-2003
   Vice-President of Near-Surface Geophysics Section of SEG, 2001-2002
   Editor of the Near-Surface Geophysics Section bimonthly newsletter, 2000-2001

   Secretary of Near Surface Geophysics Section of SEG, 1999-2000

Scientific Reviews

Journal Manuscript Reviews

1. *Geophysics* (1, 1998; 3, 1999; 4, 2000; 6, 2001; 12, 2002; 7, 2003; 3, 2004; 4, 2005; 2, 2006; 4, 2007; 6, 2008; 2, 2009; 4, 2010; 2, 2011; 2, 2012; 4, 2014; 3, 2015; 2, 2017; 2, 2018)
2. *Journal of Applied Geophysics* (1, 1998; 1, 1999; 2 2002; 1, 2005; 1, 2006; 3, 2008; 1, 2009)
3. *Geophysical Research Letters* (2, 1999; 2, 2001; 3, 2005; 1, 2006, 2, 2007; 3, 2008; 2, 2009; 4: 2012; 5, 2014; 1, 2017)
4. *International Journal of Remote Sensing* (1, 2001)

Grant Proposal Reviews

1. Department of Energy (1; 2005; 3, 2006; 6, 2008; 2, 2009; 12, 2010; 4, 2012)
2. National Science Foundation (1, 1999; 4, 2000; 5, 2001; 4, 2002; 3, 2003; 2, 2004; 5, 2005; 2, 2006; 6, 2007; 4, 2008; 3, 2009; 2, 2010; 3, 2011; 2, 2012; 3, 2014)
3. Natural Environment Research Council (1, 2000; 1, 2002; 1, 2005; 1, 2009)
4. Swiss National Science Foundation (1, 2009)

Abstract Reviews

1. Society of Exploration Geophysicists Expanded Abstracts for Annual Meetings (2, 1998; 4, 1999; 4, 2000; 26, 2002; 18, 2003; 32, 2004; 20, 2005; 18, 2006; 9, 2007; 6, 2008; 12, 2017)
2. Proceedings of the International Conference on Ground-Penetrating Radar (4, 1998; 6, 2006)
3. Symposium on the Application of Geophysics to Engineering and Environmental Problems (3, 2000; 3, 2001; 8, 2007; 4, 2008; 6, 2010; 41, 2011; 4, 2012)

Book Reviews

1. American Association for the Advancement of Science (2, 2000; 1, 2001; 1, 2002; 1, 2003; 1, 2007)

Invited Lectures and Presentations (without published abstract)

1. “Advances in Hydrogeophysics” Invited seminar presented to the Department of Physical & Environmental Sciences, Colorado Mesa University, April 2019.
2. “Advances in Hydrogeophysics” Invited seminar presented to the Department of Geology, Slippery Rock University AND The Pittsburgh Geological Society, Pittsburgh, Jan 2012.
3. “Advances in Hydrogeophysics” Invited seminar presented to the Department of Geology, West Chester University, West Chester PA, November 2012.
4. “Advances in Hydrogeophysics” Invited seminar presented to the Department of Geology & Geophysics, Univ. of Wyoming, Laramie, September 2012.
5. “Improving student comprehension of scientific and societal complexities associated with energy resources through a field-based strategy” Invited workshop presentation for a workshop on *Teaching Energy Awareness: Understanding Sources and Uses* sponsored by the Climate Literacy and Energy Awareness (CLEAN) Pathway project, April 2011.
6. “Advances in Hydrogeophysics” Invited seminar presented to the Department of Geology, Univ. of Kentucky, Lexington, October 2010.
7. “Advances in Hydrogeophysics” Invited seminar presented to the Department of Geology, Williams College, Massachusetts, April 2010.
8. “Geophysics for Water Resources and Contaminants” Invited seminar for EEGU (the public educational forum of the Environmental and Engineering Geophysical Society), Fort Worth TX, April 2009.
9. “New Geophysical Methods for detection of NAPL” Invited seminar presented to the Remedial Systems Optimization Initiative, Las Vegas NV, February 2008.
10. “Advances in Hydrogeophysics” Invited seminar presented to the Department of Geology, State University of New York at Geneseo, “Fifth Annual American Rock Salt Lecturer” April 2008.
11. “Geophysics for Water Resources and Contaminants” Invited seminar for EEGU (the public educational forum of the Environmental and Engineering Geophysical Society), Philadelphia PA, April 2008.
12. "Recent advances of seismic applications in environmental geophysics," Invited lecture presented at the International Conference on Environment and Engineering Geophysics (ICEEG), Wuhan, China, June 16-20, 2008. (Special invited guest of the China University of Geosciences.)
13. “Advances in Hydrogeophysics” Invited seminar presented to the Department of Geology and Geophysics, Texas A & M, invited workshop, College Station, TX, April 2006.
14. “Alpine glaciers, bedrock fractures, groundwater pollutants, evolving mountain-belts, Mars analogues, Roman forts: The many faces of near-surface geophysics,” Invited seminar presented to the Dept. of Earth and Environmental Sciences, Lehigh University, April 2005.
15. “Alpine glaciers, bedrock fractures, groundwater pollutants, evolving mountain-belts, Mars analogues, Roman forts: The many faces of near-surface geophysics,” Invited seminar presented to the Dept. of Earth and Planetary Sciences, University of Tennessee, February 2005.
16. “Hydrogeophysics and Fractured Rock Applications,” Invited seminar presented at the Buffalo Association of Professional Geologists (BAPG), Buffalo NY, November 2004.

17. “Applications of Near-Surface Geophysical Imaging in Jordanian Archaeology and Alaskan Glaciology,” Invited seminar presented to the Dept. of Geology and Planetary Sciences, University Pittsburgh, October 2004.
18. "Hydrogeophysics and Fractured Rock Applications," Invited seminar presented at the Geomatrix 2004 Hydrogeology Discipline Meeting, Buffalo NY, September 2004.
19. "Applications of Near-Surface Geophysical Imaging in Jordanian Archaeology and Alaskan Glaciology," Invited seminar presented to the Dept. of Geology, University at Buffalo, April 2003.
20. "Fire and Ice: Applications of Near-Surface Geophysical Imaging in Jordanian Archaeology and Alaskan Glaciology," Invited seminar presented to the Dept. of Geology, University of Delaware, February 2003.
21. "Fire and Ice: Applications of Near-Surface Geophysical Imaging in Jordanian Archaeology and Alaskan Glaciology," Invited seminar presented to the Dept. of Geology, University of Kansas, February 2003.
22. “Sparkplugs, Farm Plows, and Speakers: Stupid (but successful) Experiments of a Geophysicist,” Invited seminar presented to the Dept. of Geology at SUNY Binghamton, February 2001.
23. “Sparkplugs, Farm Plows, and Speakers: Stupid (but successful) Experiments of a Geophysicist,” Invited seminar presented to the Dept. of Geology at SUNY Geneseo, October 2001.
24. “Sparkplugs, Farm Plows, and Speakers: Stupid (but successful) Experiments of a Geophysicist,” Invited lecture presented at the Western New York Science and Technology Forum, University at Buffalo, Oct. 18, 2000.
25. “Sparkplugs, Farm Plows, and Speakers: Stupid (but successful) Experiments of a Geophysicist,” Invited seminar presented to the Dept. of Geology at Slippery Rock University, Oct. 25, 2000.
26. “Applications and Technological Advances in Environmental Geophysics,” Invited seminar presented to the Dept. of Geology at the University of Massachusetts, Oct. 15, 1999.
27. “Geophysical Reflection Imaging of Near-Surface Stratigraphy,” Invited seminar presented to the Dept. of Geology at Wright State University, April 8, 1999.
28. “Geophysical Reflection Imaging of Near-Surface Stratigraphy,” Invited seminar presented to the Dept. of Geology at The University of Kansas, March 18, 1999.
29. “Geophysical Reflection Imaging of Near-Surface Stratigraphy,” Invited seminar presented to the Dept. of Geology at SUNY Stony Brook, March 5, 1999.
30. “Geophysical Reflection Imaging of Near-Surface Stratigraphy,” Invited seminar presented to the Dept. of Earth and Atmospheric Science at Purdue University, March 2, 1999.
31. “Geophysical Reflection Imaging of Near-Surface Stratigraphy,” Invited seminar presented to the Dept. of Geology at Kansas State University, Feb. 2, 1999.

Public Relations/Publicity

1. “Understanding the KY earthquake,” interviewed by Ben Senger and filmed, WBIR Channel 10 news, and aired on 11/8/12.
2. “University professor incorporates Japan earthquake tragedy into course,” interviewed by Ben Senger and lecture/students filmed, WBIR Channel 10 news, and aired on 4/8/11.

3. "Private sector slowly following government's lead," interviewed by Josh Flory, Knoxville News Sentinel, and published 4/21/08.
4. "Sites on the solar energy tour," interviewed by Josh Flory, Knoxville News Sentinel, and published 9/29/08.
5. "Knoxville roofs catch some rays—solar tour to display panels at private homes/businesses," interviewed by David Smith, Knoxville News Sentinel, and published 9/30/08.
6. "Karst and sinkholes in East Tennessee," interviewed by Ben Senger, WBIR Channel 10 news, and aired on 2/24/06.
7. "Geophysics, GPS Technology Play Important Roles In Excavation Of Ancient Roman Fort," on University at Buffalo National News 10/22/04, www.buffalo.edu/news.
8. "Geophysics, GPS Technology Play Important Roles In Excavation Of Ancient Roman Fort," on ScienceDaily 10/25/04, www.sciencedaily.com.
9. "Geophysics, GPS Technology Play Important Roles In Excavation Of Ancient Roman Fort," on Archaeologica 10/25/04, www.archaeologica.com.
10. "Glaciers at Work," written by Jan A Piotrowski, in "News and Views" review in *Nature*, 14 August 2003, Volume 424, 737-738.
11. "Dirty Glaciers: Research Explains Why Some Glaciers Get Dirty," written by Lee Dye, on ABCNEWS.com, August 21st, 2003.
12. "UB professor talks about bringing more and different people into the field of earth sciences," on WBFO by Gabe DiMaio, January 3rd, 2003.
13. "Using non-invasive tools, UB Geophysicists find an ancient settlement buried beneath a Roman fort in the Jordanian Desert," on WBFO by Gabe DiMaio, November 29th, 2002
14. "Romans on top" (Geophysics for Archaeology), *New Scientist,* vol 176 issue 2368 - 09 November 2002, page 26.
15. "Geophysicists find ancient settlement" by Ellen Goldbaum 2002, *UB Reporter*, *34*, no 6, 4.

Professional and Academic Honors in Chronological Order

1. Awarded "Highlight Publication" for DOE Subsurface Biogeochemical Research (SBR) program (Kowalsky, M. B., E. Gasperikova, S. Finsterle, D. Watson, G. **Baker**, and S. S. Hubbard, 2011, Coupled modeling of hydrogeochemical and electrical resistivity data for exploring the impact of recharge on subsurface contamination, *Water Resour. Res.*, 47), April 26, 2011
2. TASC, Inc. (The Analytic Sciences Corporation), Recognition Award ("For outstanding contributions to TASC in the 2010 IRAD Program"), September 15 2010.
3. Early Career Award, awarded in 2008 by the Environmental & Engineering Geophysical Society, *to acknowledge "academic excellence in the field of near-surface geophysics." The award, presented annually to a full-time faculty member who is within ten years following completion of the Ph.D., acknowledges "significant and ongoing contributions to environmental and engineering geophysics."*
4. Quest Scholar of the Week, University of Tennessee, April 10 2009
5. Outstanding Service award, Near-surface Geophysics Section of the Society of Exploration Geophysicists, Presented Fall 2005
6. Certificate of Recognition, University at Buffalo Class of 2003 "Year After Graduation"

Student Survey of Undergraduate and Graduate Students, Presented Spring 2005
7. Selected to University at Buffalo, College of Arts and Sciences Honor Roll of Top Teachers, 2003-2004
8. Selected to University at Buffalo, College of Arts and Sciences Honor Roll of Top Teachers, 2002-2003
9. Selected to University at Buffalo, College of Arts and Sciences Honor Roll of Top Teachers, 2001-2002
10. Milton Plesur 2001 Excellence in Teaching Award, presented by the Student Association of the University at Buffalo (SUNY) to recognize teaching excellence and commitment to students. Recipients of the Plesur award are student-nominated and selected.
11. Top-25 ranked technical presentation (out of 587) at Society of Exploration Geophysicists (SEG) 1999 National meeting
12. Erasmus Haworth Graduate Honors Award for Outstanding Doctoral Student, Dept. of Geology, Univ. of Kansas, 1999
13. Outstanding Graduate Teaching Award, Dept. of Physics and Astronomy (Intro. to Meteorology), Univ. of Kansas, 1998
14. Dean A. McGee Scholarship, Dept. of Geology, Univ. of Kansas, 1996 - 1998
15. Society of Exploration Geophysicists (SEG) Scholarship, 1996 - 1999
16. Donnel Foster Hewett Award, Dept. of Earth and Env. Sci., Lehigh University, 1992
17. Top Field Geologist Award, Dept. of Earth and Env. Sci., Lehigh University, 1991

University Service (Colorado Mesa University, 2019-present)

University

1. Assessment Committee, 2020-present
2. Ad Hoc Essential Learning Working Group, 2020-2021
3. Sabbatical Committee, 2019-present
4. Steering Committee for CMU Water Ed Needs Assessment, Hutchins Water Center, 2020-present
5. Participant in *CRM Advise* training workshop, February 2020
6. *Mesa Experience* representative, PES, February 2020 & October 2019
7. Table Host, Etiquette Dinner, Sponsored by Career Services, Fall 2020 & Fall 2019

Department of Physical and Environmental Sciences

1. Majors Fair Department Representative, Spring 2021
2. Assessment Coordinator, Dept. of Physical & Environmental Sciences, 2020-present
3. Faculty advisor, Sigma Gamma Epsilon (SGE) Honors Society, Zeta Nu Chapter, 2019-present
4. Search committee member, Field Camp Instructor, 2020-2021
5. Faculty search committee member, Clastic Sedimentologist, 2019-2020

Geology Program

1. Ad Hoc Committee: Environmental Geology Major & Watershed Science Minor curriculum redesign, 2019-present

University Service (University of Kansas, 2015-2019)

University

1. N/A

College of Arts and Sciences

1. Center for Teaching Excellence (CTE) Teaching Fellow, 2016

Department of Geology

1. Introductory Course Lab Redesign, Dept. of Geology, 2016

University Service (University of Tennessee, 2005-2014)

University

1. Undergraduate Council, 2012-2014
2. Ambassador: University of Tennessee Teaching & Learning Center (TENN TLC), 2009-2014
3. Member: Classroom & Instructional Technology Improvement Subcommittee (Dr. Bill Dunne, Subcommittee Chair), 2006-2010
4. Member: Synchronous Learning Task Force (Dr. Bill Dunne, Task Force Chair), 2007-2008

College of Arts and Sciences

1. Undergraduate Curriculum Committee, College of Arts and Sciences, 2012-2014
2. Undergraduate Advisor, College of Arts and Sciences Advising Center, 2005-2009
3. Member, Earth & Planetary Sciences Department Head search committee, 2008-2009

Department of Earth & Planetary Sciences

1. Director of Undergraduate Studies, Dept. of Earth and Planetary Sciences, 2010-2012
2. Field Camp Advisor, Dept. of Earth and Planetary Sciences, 2005-2012
3. Chair, Departmental Teaching Peer Review Committee (Dr. Devon Burr), 2011
4. Member, Undergraduate Studies Committee, Dept. of Earth and Planetary Sci., 2005-2010
5. Chair, Adjunct Faculty Appointments Committee, 2008-2010
6. Chair, Departmental Teaching Peer Review Committee (Dr. Micah Jessup), 2009
7. Chair, Geology Introductory Course Sequence Evaluation Committee (GICSEC), 2006-2007
8. Member: Faculty Search Committee, Structural Geologist Position, Fall 2005

University Service (University at Buffalo, 1999-2005)

University

1. Alternate Representative, University at Buffalo Faculty Senate, 1999-2004
2. Founder, *University at Buffalo Journal of Undergraduate Research* (UBJUR), 2001
3. Editor, *University at Buffalo Journal of Undergraduate Research* (UBJUR), 2001-2005

College of Arts and Sciences

1. Member, College of Arts and Sciences Student Academic Life Committee, Univ. at Buffalo, 2000-2004

Department of Geology

1. Director of Undergraduate Studies, Department of Geology, 2000-2005
2. Director, Summer Geology Field Program ("Field Camp"), Department of Geology, 2001-2005
3. Departmental Web Site Supervisor, Dept. of Geology, 2000-2004
4. Chairman, Department of Geology Rock Garden Committee, Dept. of Geology, 2000-2002
5. Member, Technician Search Committee, Dept. of Geology, 2002
6. Member, BS Degree Program Development Committee, Dept. of Geology, 2000
7. Member, Introductory Course Restructuring Committee, Dept. of Geology, 2000-2002

Community Service

1. Presentation to "Seniors for Creative Learning" at John T. O'Connor Senior Center, Oct. 2009.
2. Member, 2009 Knox County Solar Tour, Knoxville TN, 2009, 2010
3. Pro-bono consulting for Old Virginia Beaureu of Investigation, Roanoke VA, 2007
4. Board of Directors, Western New York Land Conservancy, East Aurora, NY, 2000-2004
5. Pro-bono consulting for Old Fort Niagara Association at the Fort Niagara Site, Niagara Falls, NY, 2001-2004
6. Pro-bono consulting for Gettysburg Historical Association at a site near the Gettysburg battlefield, Gettysburg, PA, 2002-2004
7. Pro-bono consulting for Buffalo Conservation Coalition at the Erie Canal Terminus Site, Downtown Buffalo, NY, 2000

Courses Taught (Colorado Mesa University, 2019-present)

Semester	Course*	Title	Credit Hours	Enrol.
Summer 2021	GEOL 480	Summer Field Camp (taught 2 weeks out of 6 total)	2 (6)	16
Spring 2021	GEOL100	Survey of Earth Science	3	28
Spring 2021	GEOL 113/113L	Field Based Introduction to Physical Geology	4	8
Spring 2021	GEOL496/496L	Topics: Introduction to Drones in the Earth Sciences	4	7
Fall 2020	GEOL 100	Survey of Earth Science	3	33
Fall 2020	GEOL 103	Weather and Climate	2	97
Fall 2020	GEOL 113/113L	Field Based Introduction to Physical Geology	4	16
Fall 2020	GEOL 415/415L	Introduction to Ground Water	4	6
Summer 2020	GEOL 496	Topics: Field Methods in Hydrogeology	4	2
Spring 2020	GEOL100	Survey of Earth Science	3	35
Spring 2020	GEOL 113/113L	Field Based Introduction to Physical Geology	4	14
Spring 2020	GEOL 415/415L	Introduction to Ground Water	4	4
Fall 2019	GEOL 100	Survey of Earth Science	3	96
Fall 2019	GEOL 103	Weather and Climate	2	100
Fall 2019	GEOL 111L	Geology Laboratory (Section 001)	1	22
Fall 2019	GEOL 111L	Geology Laboratory (Section 007)	1	18
Fall 2019	GEOL 355	Basic Hydrology	3	18

Courses Taught (University of Kansas, 2015-2017)

Semester	Course*	Title	Credit Hours	Enrmt. Ugr/Gr
Fall 2017	Geology 171	Earthquakes and Natural Disasters	3	61
Fall 2017	Geology 103	Introductory Geology Laboratory	2	160
Spring 2016	Geology 171	Earthquakes and Natural Disasters	3	47
Fall 2015	Geology 775	Near Surface Seismology	3	5

Courses Taught (Johnson County Community College, 2018-2019)

Semester	Course*	Title	Credit Hours	Enrmt. Ugr/Gr
Winter 2018	JCCC 2675	Part 107 Test Preparation for Drone Pilot License	1	4
Summer 2018	JCCC 2675	Part 107 Test Preparation for Drone Pilot License	1	6
Fall 2018	JCCC 2675	Part 107 Test Preparation for Drone Pilot License	1	11

Courses Taught (South Dakota School of Mines and Technology, 2014-2018)

Semester	Course*	Title	Credit Hours	Enrmt. Ugr/Gr
Summer 2018	Geology 410	Field Geology (South Dakota and Wyoming)	6	21
Summer 2017	Geology 410	Field Geology (South Dakota and Wyoming)	6	28
Summer 2016	Geology 410	Field Geology (South Dakota and Wyoming)	6	32
Summer 2015	Geology 410	Field Geology (South Dakota and Wyoming)	6	29
Summer 2014	Geology 410	Field Geology (South Dakota and Wyoming)	6	28

Courses Taught (Illinois Wesleyan University, 2014-2015)

Semester	Course*	Title	Credit Hours	Enrmt. Ugr/Gr
Spring 2015	ENST 110	Earth Systems Science	3	25
Fall 2014	ENST 115/ PHYS 120	Energy and Society	3	14
Fall 2014	ENST 110	Earth Systems Science	3	14
Spring 2014	ENST 270	Introduction to GIS	3	13
Spring 2014	ENST 110	Earth Systems Science	3	24

Courses Taught (University of Tennessee, 2005-2013)

Semester	Course*	Title	Credit Hours	Enrmt. Ugr/Gr
Spring 2013	Geology 548	Sequence Stratigraphy	3	4/8
Spring 2013	Geology 596	Oral Communication of Scientific Ideas	1	10
Fall 2012	Geology 101	Dynamic Earth	4	213
Spring 2012	Geology 471	Applied Geophysics	3	16
Fall 2012	Geology 101	Dynamic Earth	4	283
Spring 2011	Geology 470/570	Applied Geophysics	3	8/10
Fall 2010	Geology 101	Dynamic Earth	4	148/0
Spring 2010	Geology 590	Sequence Stratigraphy	4	3/9
Fall 2009	Geology 101	Dynamic Earth	4	145/0
Sum 2009	Geology 107	Honors: Energy Resources Field Course	4	18/0
Spring 2009	Geology 470	Applied Geophysics	3	10/3
Spring 2009	Geology 675	Seminar in Geophysics	3	0/3
Fall 2008	Geology 101	Dynamic Earth	4	146/0

Sum 2008	Geology 471	TINGS (Near-Surface Geophysics Field Course)	3	7/6
Spring 2008	Geology 590	Sequence Stratigraphy	3	0/6
Fall 2007	Geology 101	Dynamic Earth	4	146/0
Fall 2006	Geology 101	Dynamic Earth	4	147/0
Sum 2006	Geology 471	TINGS (Near-Surface Geophysics Field Course)	3	4/7
Spring 2006	Geology 470	Applied Geophysics	3	3/5
Fall 2005	Geology 101	Dynamic Earth	4	148/0

*100-level course are introductory sequences, 400/500- level courses are upper-level undergraduate electives and/or lower level graduate courses, and 600-level courses and above are graduate courses.

Courses Taught (University at Buffalo, 1999-2005)

Semester	**Course***	**Title**	**Credit Hours**	**Enrmt. Ugr/Gr**
Summer 2005	GLY 407/507	Geological Field Training (Director)	6/2	40/0
Spring 2005	GLY 419/519	Environmental Geophysics	3/3	15/5
Fall 2004	GLY 101	Global Environmental Science	4	240
	GLY 325	Geophysics/Tectonics	4	30
Summer 2004	GLY 407/507	Geological Field Training (Director)	6/2	38/2
Fall 2003	GLY 101	Global Environmental Science	4	205
	GLY 521	Hydrogeophysics	3	9
Summer 2003	GLY 407/507	Geological Field Training (Director)	6/2	37/1
Spring 2003	GLY 419/519	Environmental Geophysics	3/3	7/5
Fall 2002	GLY 101	Global Environmental Science	4	186
	GLY 325	Geophysics/Tectonics	4	23
Summer 2002	GLY 407/507	Geological Field Training (Director)	6/2	38/2
Spring 2002	GLY 419/519	Environmental Geophysics	3/3	10/5
Fall 2001	GLY 101	Global Environmental Science	4	170
	GLY 325	Geophysics/Tectonics	4	12
Summer 2001	GLY 407/507	Geological Field Training (Instructor)	6/2	40/0
Spring 2001	GLY 419/519	Environmental Geophysics	3/3	1/8
Fall 2000	GLY 101	Global Environmental Science	4	106
	GLY 325	Geophysics/Tectonics	4	16
Summer 2000	GLY 407/507	Geological Field Training (Instructor)	6/2	39/1
Spring 2000	GLY 326	Geophysics/Tectonics	4	31/1
Fall 1999	GLY 101	Global Environmental Science	4	74

*100-level course are introductory sequences, 300-level courses are upper-level undergraduate major sequence courses, 400-level courses are upper-level undergraduate electives, and 500-level courses are graduate courses. Courses indicated with two numbers (4**/5**) are cross-listed for both undergraduate and graduate students.

Other Teaching Activities

Formal

Semester	Supervising Institution	Course #	Course Name	Length/ Credits	Enrmt.
Sum 2009	UT	Geol 101	Earth's Energy Resources (Introductory Honors Field Course in WY, CO, UT	3 wks 1 cr	18
Spr 2009	EEGS	N/A	Geophysics for Water Resources and Contaminants	1 da	18
Spr 2008	EEGS	N/A	Geophysics for Water Resources and Contaminants	1 da	15
Spr 2007	SUNY Geneseo	N/A	Near Surface Seismology	1 wk n/a	9
Spr 2006	TX A&M	N/A	Near Surface Seismology	1 wk n/a	14
Sum 2002	NW Missouri	N/A	NSF Research Experiences for Undergrads (REU) Program, Matanuska Glacier, Alaska	4wks	6
Sum 2001	Augustana College	N/A	NSF Research Experiences for Undergrads (REU) Program, Matanuska Glacier, Alaska	4 wks	5
Sum 2000	Augustana College	N/A	NSF Research Experiences for Undergrads (REU) Program, Matanuska Glacier, Alaska	4 wks	6
Sum 1999	Lehigh Univ.	EES 41	Introductory Geology in the Rocky Mountains	6.5 wks/ 6 cr	24
Sum 1998	Lehigh Univ	EES 41	Introductory Geology in the Rocky Mountains	6.5 wks/ 6 cr	28
Sum 1997	Lehigh Univ	EES 41	Introductory Geology in the Rocky Mountains	6.5 wks/ 6 cr	34
Sum 1996	Lehigh Univ	EES 41	Introductory Geology in the Rocky Mountains	6.5 wks/ 6 cr	26

Informal

1. Led optional 4-day field trip for students attending the American Geophysical Union conference (5 students attending) through the Seirra Nevada Mountains and Yosemite Nat'l Park (California), Fall 2008.
2. Led optional 4-day field trip for students attending the Geological Society of America conference (7 students attending) through the Northern Rocky Mountains (Wyoming, Colorado), Fall 2006.
3. Led optional 5-day field trip for students in Geophysics/Tectonics class (generally 18-26 students attending) through the Taconic orogen (New York, Vermont, New Hampshire), Fall 1999, 2000, 2001, 2002, 2003, 2004.
4. Led optional weekend Niagara Falls field trip for students in introductory Global Environmental Science class (generally 18-35 students attending), Fall 1999, 2000, 2001.
5. Organized and participated in van trip to Boston, MA, for a national geology conference (GSA), and led informal field trips in the region (16 students attended) Fall 2001.
6. Organized and participated in van trip to Burlington, VT, for a regional geology conference (NE-GSA), and led informal field trips in the region (15 students attended) Fall 2000.
7. Organized and participated in van trip to Denver, CO, for a national geology conference (GSA), and led informal field trips in the Rocky Mountains (9 students attended: 7 graduate students from SUNY Buffalo; 2 from SUNY Fredonia), Fall 1999.

Supervised Students

Graduate Students, Major Advisor

Graduated Ph.D.

1. Megan Carr, Ph.D. 2013, Quantitative integration of multiple near-surface geophysical techniques for improved subsurface imaging
2. Prasanta Yeluru, Ph.D. 2013, Determining engineering properties of the upper 30 m of the Lunar subsurface using surface wave techniques
3. David Gaines, 2010, Advances in Seismic First-Arrival Tomography: PhD dissertation, University of Tennessee
4. Laura Gilcrist, 2009, Component analysis of very near surface seismic wave propagation and an examination of resonant frequencies in three soils: PhD dissertation, University at Buffalo.
5. Vaughan, Raymond, 2007, A method of three-dimensional gravity modeling to obtain subsurface density, illustrated by data from Western New York State: PhD dissertation, University at Buffalo.
6. Jordan, Thomas, 2003, Amplitude and phase variation with offset (APVO) analysis of ground penetrating radar data: PhD dissertation, University at Buffalo.

In Progress M.S.

1. William Arant, M.S., 2011-present, Developing a swept-frequency near-surface acoustic seismic source.

Graduated M.S.

1. Carolyn Tewsbury-Christle, M.S., 2013, Ground Penetrating Radar Investigations on the Relationship between Salinity in Fluid-filled Horizontal Sub-wavelength 'Thin-layer' Bedrock Fractures and Reflection Amplitudes
2. Matthew Edmunds, M.S., 2012, Assessing azimuthal seismic first-arrival tomography for estimating saprolite and bedrock fracture anisotropy
3. Rachel Sotrniolo, M.S., 2012, Determining vadose-zone hydraulic conductivity using time-lapse seismic first-arrival tomography
4. Caitlyn Williams, M.S., 2011, Improving geophysical data acquisition, processing, and analysis rates for multi-tool archaeology investigations: M.S. thesis, University of Tennessee.
5. Burns, K.E., 2008, Ground penetrating radar investigations on the relationship between horizontal sub-wavelength 'thin layer' bedrock fractures and reflection amplitudes: M.S. thesis, University of Tennessee.
6. Stokes, Philip J., 2007, Ground penetrating radar investigation of the Late Quaternary Hiscock site, Western New York State, USA: M.S., thesis, University at Buffalo.
7. Sturtevant, Kristin A., 2007, Integrating multiple geophysical techniques to analyze geologic controls of riparian meadow complexes, Central Great Basin, NV: M.S., thesis, University at Buffalo.
8. Ambrose, H.M., 2005, Improving archaeological geophysics surveys through improved visualization and multitool data integration, M.S. thesis, University at Buffalo.
9. Beyrle, Nicholas, 2005, Using polarized geound penetrating radar to improve subsurface imaging of bedrock fractures, M.S. thesis, University at Buffalo.
10. Talley, Jennifer, 2005, Imaging channelized flow in fractured rock using GPR: M.S., thesis, University at Buffalo.
11. Malinowski, Matthew, 2004, Effects of source energy and soil moisture on near-source, nonlinear deformation associated with near-surface seismic reflection sources: M.A. thesis, University at Buffalo.
12. Mayer, Calista M., 2004, Azimuthal resistivity analysis using a capacitively-coupled resistivity meter for the determination of fracture orientations: M.S. thesis, University at Buffalo.
13. Saunders, Mark D., 2003, Integrating multiple geophysical methods to determine depth to bedrock and subsurface stratigraphy in a buried glacial valley: Ischua Valley, Cattaraugus County, New York: M.S. thesis, University at Buffalo.
14. Evenick, Jonathan, 2002, An Investigation of the Subsurface Geology of Northeastern Chautauqua County, New York: M.S. thesis, University at Buffalo.

Graduate Students, Thesis/Dissertation Committee Member

Graduated

1. Kathleen Warrell, MS 2013, Detailed geologicl studies of paleoseismic features in the Eath Tennessee Seismic Zone: Evidence for large prehistoric earthquakes, University of Tennessee.
2. Craig Hardgrove, PhD 2010, Hyperspectral imaging of potential alluvial fans on Mars, University of Tennessee.
3. Jennifer Whisner, PhD 2010, Structural controls in the Southern Appalachians, University of Tennessee.
4. Peter Knappett, PhD 2010, Fate and transport of fecal contaniments in Bangladesh, University of Tennessee.
5. Boehm, David, MS 2003, A comparative study of seasonal bluff erosion at Lakeside Beach State Park, Orleans County, New York: University at Buffalo.
6. Budny, Lucas E., MS 2002, An Innovative Method for Ascertaining Tortuosities in Dry and Moist Porous Media and the Delineation of Tectonic Structures Using Soil Gas in Southern Seneca and Northern Schuyler Counties, New York: University at Buffalo.
7. Cruz, Cheri, MS 2005, Comparison of lineament analysis from remote sensing data with field data: University at Buffalo.
8. Fredrick, Kyle C., 2008, Determining effective data requirements for evaluating regional aquifers using the analytic element method: University at Buffalo.
9. Goudy, Cheryl, MS 2002, Wrinkle Rodges of Hesperia Planum, Mars: Implications for the Evolution of Ridges Plains: University at Buffalo.
10. Leao, Tiarone, PhD 2008, Effects of Water Content and Salinity on Soil Electrical Properties at 50 MHz: Structural and Textrual Implications: University of Tennessee.
11. Nettles, Jeff, PhD 2007, Characterization of the least-melted chondrules in meteorites and impact on nebular sorting: PhD University of Tennessee.
12. Schuetz, James W., MS 2002, Numerical modeling of seasonal variability in ground-water flow near Mirror Lake, Grafton County, New Hampshire: University at Buffalo.
13. Spitzer-List, Tara M., PhD 2003, The use of surface temperatures and temperature profiles to identify and quantify ground-water discharge and recharge areas in wetlands: University at Buffalo.
14. Whisner, Jennifer, PhD 2010, Structural controls in the Southern Appalachians: University of Tennessee.

Graduate Students, Other Activities

1. Todd C. Witmer, Independent Graduate Research, 2001
2. Lucas Bundy, Independent Graduate Research, 2001
3. Paul Zaratin, Independent Graduate Research, 2000

Undergraduate Students, Supervised research and other activities

1. Sara Long, Independent Research, Fall 2012-Spring 2013
2. Andrea Gregg, Independent Research, Fall 2010-Spring 2012
3. Christian Hunkus, Independent Research, Fall 2010-Spring 2012
4. Noah McDougall, Independent Research, Spring 2010-Sprin 2011
5. Matthew Edmunds, Independent Research, Fall 2009-2010
6. James A. Pratt, Independent Research, Spring 2008-2010
7. Morgan Braxton-Sears, Independent Research, Fall 2007- Spring 2009
8. Brittany Davis, Senior Thesis Research, Spring 2006
9. Cheri Drechsel, Independent Research, Spring 2000
10. Mike Dunlap, Independent Research, Spring 2000
11. Chris Kibler, Independent Research, Spring 2000, Fall 2000
12. Adiel Gavish, Independent Research, 2002
13. Laura Gilchrist, Senior Thesis Research, 2002-2003
14. Theresa Lawler, Senior Thesis Research, 2001-2002
15. Calista McIntyre, Senior Thesis Research, 1999-2002
16. Robert Piurek, Independent Research, 2002-2003
17. James Pratt, Independent Research, 2007-present
18. Kendra Pyke, Senior Thesis Research, 1999-2002
19. Mark Saunders, Independent Research, Spring 2000
20. Kristin Sturtevant, Senior Thesis Research, 2002-2004
21. William Shaffer, Independent Research, 2002
22. Jennifer Talley, Independent Research, 2002
23. Laura Walzcak, Independent Research, 2000-2001

Honors and Awards of Supervised Students

1. Noah McDougall (undergraduate research) was awarded the University of Tennessee Chancellors Honors Award for "Undergraduate Extraordinary Professional Promise" April 12 2011.
2. *Best Paper Award,* Kristin Sturtevant for "Combining Multiple Seismic and Ground Penetrating Radar Techniques to Analyze Shallow Structure and Stratigraphy Associated With Riparian Meadow Complexes, Central Great Basin, Nevada USA" presented at the 2007 Symposium of Application in Geophysics for Environmental & Engineering Problems. Dallas, TX. April 13-18, 2007.
3. *Best Poster Presentation ($650),* Kristin Sturtevant for "Combining Multiple Seismic and Ground Penetrating Radar Techniques to Analyze Shallow Structure and Stratigraphy Associated With Riparian Meadow Complexes, Central Great Basin, Nevada USA" presented at the 2006 Rocky Mountain Rendezvous of Geoscience Students and Employers, sponsored by AAPG and RMS-AAPG, sanctioned by SEG and GSA. Hosted by University of Wyoming Geology and Geophysics, Laramie. October 1-2, 2006.
4. *McLaughlin Undergraduate Award* ($650), Brittany Davis for undergraduate course work at the University of Tennessee.
5. *Reginald H. Pegrum Student Travel Grant ($350),* Kristin Sturtevant for Geological Society of America National Meeting, M.S. Candidate.

6. *Kenneth N. Weaver Student Travel Grant ($250),* Kristin Sturtevant for Geological Society of America Northeastern Section Meeting, M.S. Candidate.
7. *Reginald H. Pegrum Student Travel Grant ($350),* Phil J. Stokes for Geological Society of America National Meeting, M.S. Candidate.
8. *Kenneth N. Weaver Student Travel Grant ($250),* Phil J. Stokes for Geological Society of America Northeastern Section Meeting, M.S. Candidate.
9. *Mark Diamond Research Fund, University at Buffalo Graduate Student Association ($450),* Phil J. Stokes for "Geophysical imaging of a fossiliferous Pleistocene basin in Western New York" M.S. Candidate.
10. *Reginald H. Pegrum Student Travel Grant ($350),* Kristin Sturtevant for Geological Society of America National Meeting, M.S. Candidate.
11. *Reginald H. Pegrum Student Travel Grant ($350),* Phil J. Stokes for Geological Society of America National Meeting, M.S. Candidate.
12. *Kenneth N. Weaver Student Travel Grant ($250),* Phil J. Stokes for Geological Society of America Northeastern Section Meeting, M.S. Candidate.
13. *Geological Society of America Research Grant ($1500),* Phil J. Stokes for "Geophysical imaging of a fossiliferous Pleistocene basin in Western New York" M.S. Candidate.
14. *Geophysics Division Award* (Geological Society of America) for best student paper, Klaus Beyrle for "Using multiple polarization of ground penetrating radar to generate three-dimensional subsurface images of bedrock fractures" M.S. Candidate.
15. Best Student Presentation (*National Ground Water Association / U.S Environmental Protection Agency Fractured Rock Conference),* Jenn Talley, for Talley J., Becker, M.W., Baker, G.S., Beyrle, N., 2004, Imaging channelized flow in bedrock fractures using ground penetrating radar: National Ground Water Association / U.S Environmental Protection Agency Fractured Rock Conference, Portland, Maine. M.S. candidate.
16. Sigma Xi Research Award, Calista McIntyre (Mayer) for "Azimuthal resistivity analysis using a capacitively-coupled resistivity meter for the determination of fracture orientations" M.S. candidate.

PROFESSIONAL CURRICULUM VITAE

REX D. COLE
Ph.D., P.G. (retired in Spring 2020; currently Emeritus)
Professor of Geology
Colorado Mesa University

October 2019

EDUCATION

Ph.D. in Geology (1975)	University of Utah, Salt Lake City, UT Advisors: Drs. M. Dane Picard and M. Leroy Jensen
B.S. in Geology (1970)	Colorado State University, Fort Collins, CO Advisor: Dr. Stanley A. Schumm
A.S. in Geology (1968)	Mesa College, Grand Junction, CO Advisor: Dr. Robert G. Young
High School Diploma (1966)	Delta High School, Delta, CO

PROFESSIONAL REGISTRATION

Registered Professional Geologist (Wyoming) since 1992; Number PG-463

PROFESSIONAL EXPERIENCE

2011- Professor of Geology; Department of Physical and Environmental Sciences, Colorado Mesa University, Grand Junction, CO; also Geology Program Coordinator from 2009-2013.

1999-11 Professor of Geology; Department of Physical and Environmental Sciences, Mesa State College, Grand Junction, CO; also Geology Program Coordinator.

1995-99 Associate Professor of Geology; Department of Physical and Environmental Sciences, Mesa State College, Grand Junction, CO.

1983-95 Sr. Advising Geologist; Unocal Corp., Production and Development Technology Group, Brea, CA.

1982- Consulting Geologist; R.D. Cole and Associates, Grand Junction, CO.

1980-82 Manager of Geotechnical Operations; Multi Mineral Corp., Grand Junction, CO.

1978-80 Staff Geoscientist IV; Bendix Field Engineering Corporation, Grand Junction, CO.

1975-77 Assistant Professor of Geology; Department of Geology, Southern Illinois University, Carbondale, IL.

1973-75 Exploration Geologist; American Smelting and Refining Company, Salt Lake City, UT (part time).

1970-73 Teaching Fellow and Research Assistant; Department of Geology and Geophysics, University of Utah, Salt Lake City, UT (academic months).
1971 Exploration Geologist; Inspiration Development Company, Spokane, WA (summer).
1970 Exploration Geologist; Duval Corporation, Salt Lake City, UT (summer).
1968 Assistant Geologist; Petro-Nuclear Ltd., Naturita, CO (summer).

EXPERTISE

Sedimentology, stratigraphy, siliclastic reservoir characterization, energy resources, mineral resources, geochemistry, geotechnical writing/editing, project management, and administration.

ANALYTICAL QUALIFICATIONS AND SKILLS

Petrographic microscope, gas-source mass spectrometer, x-ray diffractometer, x-ray fluorescence spectrometer, scanning-electron microscope, gamma-ray spectrometer, GIS/GPS, database management, well-log analysis (PETRA), and bore-hole imaging techniques.

UNIVERSITY AND COLLEGE COURSES TAUGHT

Physical Geology and Laboratory (Southern Illinois University and Mesa State College)
Historical Geology and Laboratory (Mesa State College and Colorado Mesa University)
Introduction to Field Studies (Mesa State College)
Geology of Colorado (Mesa State College and Colorado Mesa University)
Stratigraphy and Sedimentology (Southern Illinois University and Mesa State College)
Sedimentology and Stratigraphy (Mesa State College and Colorado Mesa University)
Invertebrate Paleontology and Laboratory (Mesa State College)
Survey of Energy-Related Natural Resources (Mesa State College and Colorado Mesa University)
Survey of Mineral-Related Natural Resources (Mesa State College)
Summer Field Camp (Mesa State College and Colorado Mesa University)
Stable-Isotope Geochemistry (Southern Illinois University)
Senior Seminar (Mesa State College)
Independent Study (Mesa State College)
Structured Research for Undergraduates (Mesa State College and Colorado Mesa University)
Subsurface Methods and Technology (Mesa State College and Colorado Mesa University)
Introduction to Well-Log Analysis (PETRA) (Colorado Mesa University)

PROFESSIONAL AFFILIATIONS

Geologic Society of America (since 1975)
Grand Junction Geological Society: Vice President (1978-1980); President (1980-1981and 2016-2017); Honorary Life Member (2004).
New Mexico Geological Society (since 2017)

GRANTS AND FUNDING

2017 Received a $1,000 grant from Colorado Mesa University (Faculty Development Fund) to purchase an unmanned aerial vehicle (drone) to support field research.

2016 Received $26,344 grant from Unconventional Energy Center at Colorado Mesa University to support the X-ray Mineralogy-Geochemistry Laboratory at Colorado Mesa University. Dr. William Hood was co-principle investigator.

2016 Received a $2,390 grant from the Grand Junction Geological Society to study the geochemistry of and mineralogy of the Green River Formation. Dr. William Hood was co-principle investigator.

2015 Received a $1,750.50 grant from the Grand Junction Geological Society to study the geochemistry of mafic flows and dikes in the Grand Mesa volcanic field, western Colorado.

2015 Received a $906.25 grant from Colorado Mesa University (Faculty Development Fund) to prepare petrographic thin sections of mafic flows and dikes from the Grand Mesa volcanic field, western Colorado.

2013 Received a $789.45 grant from Colorado Mesa University (Faculty Development Fund) to attend training sessions for the PETRA software system.

2013 Received a $22,661.00 grant from the Unconventional Energy Center at Colorado Mesa University to study the mineralogy and geochemistry of the Mancos Shale in western Colorado. Dr. William Hood was co-principle investigator.

2011 Received a $2,787.50 grant from Colorado Mesa University (Faculty Development Fund) for geochemical analyses of basaltic rock samples from Grand Mesa, Colorado.

2011 Received $5,000 from the Reservoir Characterization and Modeling Laboratory at the University of Colorado, Boulder, for Phase VI research on the Williams Fork Formation; funding was via the Williams Fork Consortium (funded by 10 energy companies).

2010 Coordinated acquisition of an in-kind academic license for the PETRA^{TM} software system (market value is ~$300,000).

2009 Received a grant ($32,387) from Colorado School of Mines for research on the Williams Fork Formation in the Piceance Creek Basin, CO. Funding source was from RPSEA/U.S. Dept. of Energy (project title: “Reservoir Connectivity and Stimulating Gas Flow in Tight Sands; Task 4 – Development of Static Reservoir Models”). Project completed in 2011.

2009 Received $51,125 from the Reservoir Characterization and Modeling Laboratory at the University of Colorado, Boulder, for Phase V research on the Williams Fork Formation; funding was via the Williams Fork Consortium (funded by 16 energy companies).

2007 Received $10,000 from the Reservoir Characterization and Modeling Laboratory at the University of Colorado, Boulder, for Phase IV research on the Williams Fork Formation; funding was via the Williams Fork Consortium (funded by 12 energy companies).

2005 Co-investigator on a National Science Foundation REU grant ($362,586) to Mesa State College.

2004 Received $5,000 from the Reservoir Characterization and Modeling Laboratory at the University of Colorado, Boulder, for Phase III research on the Williams Fork Formation; funding was via the Williams Fork Consortium (funded by 12 energy companies).

1977 Received $1,500 grant from the Office of Research and Projects, Southern Illinois University.

1976 Received $29,140 grant from the Coal Research Center, Southern Illinois University.
1976 Received $9,000 grant from the American Chemical Society (Petroleum Research Fund).
1973 Received $450 grant from Sigma Xi to partially fund graduate research program.

HONORS AND AWARDS

2014 Invited speaker for the monthly meeting of the Rocky Mountain Section of the Society of Economic Paleontologists and Mineralogists, Denver.
2008 Received (with Matt Pranter) the A.I. Levorsen Award for best oral presentation at the Rocky Mountain Section Meeting of the American Association of Petroleum Geologists.
2006 Received Outstanding Achievement in Scholarship Award from Mesa State College.
2005 Receive Best Paper of the Year (2005) Award from the Rocky Mountain Association of Geologists (Denver) for paper with Steve Cumella in the *Mountain Geologist*.
2004 Selected as General Chair for the 57th Meeting (2005) of the Rocky Mountain Section of the Geological Society of America.
2004 Elected Chair of the Rocky Mountain Section of the Geological Society of America.
2004 Awarded a Lifetime Membership in the Grand Junction Geological Society in recognition for prolonged service.
2004 Nominated for a distinguished faculty award (overall) at Mesa State College.
2003 Invited speaker for the monthly meeting of the Rocky Mountain Association of Geologists, Denver.
2003 Nominated for a distinguished faculty award (overall) at Mesa State College.
2002 Nominated for a distinguished faculty award (research) at Mesa State College.
1994 Nominated for a creativity award from Unocal Corporation for geological research.
1993 Nominated for a creativity award from Unocal Corporation for geological research.
1992 Invited speaker at Department of Geosciences, New Mexico Institute of Mining and Technology, Soccoro.
1992 Received special commendation from Unocal Corporation for participation in a special business venture in New Mexico.
1992 Received a creativity award from Unocal Corporation for geological research.
1991 Invited speaker at Department of Geology and Geophysics, Louisiana State University, Baton Rouge.
1990 Invited speaker at Colorado School of Mines, Golden.
1989 Invited speaker for Wyoming Geological Association, Casper.
1985 Invited speaker at University of Colorado, Denver.
1977 Elected chair of the Graduate Admissions Committee, Department of Geology and Geophysics, Southern Illinois University.
1976 Elected to the College of Science's Molecular Science Faculty (interdepartmental Ph.D.-granting program) at Southern Illinois University.

GRADUATE STUDENT INVOLVEMENT

In addition to his professional duties at Mesa State College, now Colorado Mesa University, Dr. Cole has served as an outside committee member for graduate students working in western Colorado, including the following universities:

Southern Illinois University-Carbondale (1977-1979; 2 M.S. students)
Long Beach State University (1989-1992; 1 M.S. student)
New Mexico Tech. (1990-1997; 2 M.S. students)
Northern Arizona University (1999-2003; 1 M.S. student)
University of Colorado, Boulder (2002-2015; 18 M.S. students)
University of Oklahoma (2016-2019; 3 M.S. students and 1 Ph.D. student)

SHORT COURSES, RESEARCH SYMPOSIA AND SUPPLEMENTAL TRAINING

2014 PETRA software training, conducted at the Colorado School of Mines, CO (two days).
1995 Reservoir characterization and geostatistics computer workshop, conducted by the R3 Group, in Brea, CA (five days).
1995 Invited participant in a sequence stratigraphy research/field conference conducted by the Society of Sedimentary Geology (SEPM) and American Association of Petroleum Geologists (five days, Wyoming).
1992 Reservoir characterization and geostatistics computer workshop, conducted by Mohan Kelkar in Brea, CA (three days).
1991 Invited participant in a sequence stratigraphy research/field conference conducted by the American Association of Petroleum Geologists (seven days, Utah and New Mexico), conducted by John Van Wagoner.
1988 Sequence stratigraphy of Tertiary strata in Mississippi, Alabama, and Georgia (field symposium), conducted by P.R. Vail (one week).
1988 Seismic stratigraphic and seismic facies analysis of deep-water siliciclastic systems, (short course), conducted by Geoquest International, Inc. (one week).
1988 Sequence stratigraphy and sea-level changes (field trip and workshop), conducted by Working Group I of Global Sedimentary Geology Program (three days).
1987 Sequence stratigraphy (short course), conducted by P.R. Vail (two days).
1986 Shelf sands and strandline systems (short course), conducted by the American Association of Petroleum Geologists (two days).
1986 Depositional sequences and shelf sandstones in Cretaceous strata of the San Juan basin, New Mexico (field symposium), conducted by Gulf Coast Section of Society of Economic Paleontologists and Mineralogists (three days).
1985 Seismic facies analysis (short course), conducted by Geoquest International, Inc. (one week).
1978 Depositional and ground-water flow systems in the exploration for uranium (short course), conducted by the Bureau of Economic Geology, University of Texas at Austin (two days).
1976 Carbonate depositional environments (short course), conducted by G. Friedman (one day).

DISSERTATION

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2007 **R.D. Cole**, Grand Mesa: an important control point for establishing the late Cenozoic history of western Colorado: Geological Society of America Annual (National) Meeting Program with Abstracts.

2007 N.K. Sommer, M. J. Pranter, and **R. D. Cole**, Reservoir-scale analysis of sandstone-body dimensions in a braided fluvial system, upper Williams Fork Formation, Main Canyon, Piceance Basin, Colorado: American Association of Petroleum Geologists Annual (National) Meeting, in proceedings volume.

2007 **R. Cole**, Fluvial sand-body dimensions and architecture, Neslen and Lower Farrer Formations (Campanian), lower Sego Canyon, Utah: American Association of Petroleum Geologists Annual (National) Meeting, in proceedings volume.

2007 M.J. Pranter, H.P., Q.A. German, Z.A. Reza, **R.D. Cole**, N.F. Hurley, and D.S. Anderson, Fluvial Sandstone-Body Dimensions and Reservoir Connectivity within a Meandering to Braided System: An Example From the Williams Fork Formation, Piceance Basin, Colorado: American Association of Petroleum Geologists Annual (National) Meeting, in proceedings volume.

2006 **R. Cole**, A geomorphic approach for predicting reservoir volumes in high-sinuosity fluvial sand bodies in the lower Williams Fork Formation, southwest Piceance Basin, Colorado: Rocky Mountain Section of Geological Society of America Program with Abstracts.

2006 K. Rider, A. Darling, J. Gloyd, and **R. Cole**, Relative ages and origins of late Cenozoic pediments on the south flank of Grand Mesa, Colorado: Rocky Mountain Section of Geological Society of America Program with Abstracts.

2006 Q. German, M. Pranter, and **R. Cole**, Analysis of fluvial sand-body characteristics and connectivity in a high net-to-gross system, Upper Williams Fork Formation, Plateau Creek Canyon, Piceance Basin, Colorado: American Association of Petroleum Geologists Annual (National) Meeting, in proceedings volume.

2006 N. Sommer, Q. German, M. Pranter, and **R. Cole**, Analysis of fluvial sand-body characteristics and dimensions in a high net-to-gross system, upper Williams Fork Formation, Main and Plateau Canyons, Piceance Basin, Colorado: Rocky Mountain Sectional Meeting of the American Association of Petroleum Geologists, in proceedings volume.

2005 C. Betton, A. Aslan, and **R. Cole**, Late Cenozoic erosional history and major drainage changes of the Colorado-Gunnison River systems, western Colorado: Rocky Mountain Section of Geological Society of America Program with Abstracts, p. 35.

2005 **R. Cole**, Characterization of fluvial sand bodies in the lower Williams Fork Formation (Campanian), Coal Canyon Area, Colorado: Rocky Mountain Section of Geological Society of America Program with Abstracts, p. 44.

2004 A. Ellison, M. Pranter, **R. Cole**, and P. Patterson, Quantification of stratigraphic heterogeneity within a fluvial point-bar sequence, Williams Fork Formation, Piceance Basin, Colorado: application to reservoir modeling: Rocky Mount Sectional Meeting of the American Association of Petroleum Geologists, in proceedings volume.

2004 A. Ellison, M. Pranter, **R. Cole**, and P. Patterson, Anatomy of a point bar: outcrop modeling using Lidar data for the Upper Cretaceous Williams Fork Formation, Piceance Basin, Colorado: Rocky Mountain Sectional Meeting of the American Association of Petroleum Geologists, in proceedings volume.

2004 **R. Cole**, and S. Cumella, Fluvial sand-body dimensions in the lower Williams Fork Formation (Upper Cretaceous), southwestern Piceance Basin, Colorado: Rocky Mountain Sectional Meeting of the American Association of Petroleum Geologists, in proceedings volume.

2003 A. Ellison, M. Pranter, **R. Cole**, and P. Patterson, Stratigraphic architecture of the Upper Cretaceous Williams Fork Formation, Piceance Basin, western Colorado through outcrop studies and high-resolution Lidar imaging: Geological Society of America Program with Abstracts (annual meeting).

2003 A. Ellison, M. Pranter, **R. Cole**, P. Patterson, and S. Cumella, Analysis and modeling of stratigraphic architecture of the Upper Cretaceous Williams Fork Formation, Piceance Basin, Colorado through outcrop studies and Lidar imaging: Rocky Mountain Association of Geologists Piceance Basin Field Symposium, October 5, 2003.

2003 **R. Cole**, and S. Cumella, Facies-architecture of fluvial sand bodies in the Williams Fork Formation (Upper Cretaceous), southwestern Piceance Basin, Colorado: Rocky Mountain Association of Geologists Piceance Basin Field Symposium, October 5, 2003.

2002 **R. Cole**, G. Gustason, and S. Cumella, Outcrop characterization of fluvial sandbodies in lower Williams Fork Formation, Coal Canyon area, Colorado: Rocky Mountain Sectional Meeting of the American Association of Petroleum Geologists, Laramie, Wyoming (annual meeting).

2002 R. B. Scott, T.A. Steven, C.W. Betton, **R.D. Cole**, A. Aslan, and W.C. Hood, Evidence for late Cenozoic uplift on the Uncompahgre Plateau, northeastern Colorado Plateau: Geological Society of America Program with Abstracts (annual meeting).

2002 F. Baker, J. Rundell, K. Hasebi, **R. Cole**, and A. Aslan, Geomorphic evolution of Grand Mesa, western Colorado: Geological Society of America Program with Abstracts (annual meeting).

2002 A. Aslan and **R. Cole**, Sedimentologic comparison of two new Lava Creek B ash occurrences in western Colorado: Geological Society of America Program with Abstracts (annual meeting).

2001 R.B. Scott, C.A. Quesenberry, D. Van Sistine, B. Heise, J. Gregson, W.C. Hood, and **R. Cole**, An example of a multipurpose geologic map for the Parks -- Colorado National Monument: Geological Society of America Program with Abstracts (annual meeting).

2001 J. Petermen and **R.D. Cole**, Petrographic and petrophysical characteristics of the McCracken Sandstone Member of Elbert Formation, Lisbon Field, Paradox Basin, Utah: Geological Society of America Program with Abstracts (annual meeting).

2001 **R.D. Cole** and A. Aslan, Late Cenozoic erosional evolution of Grand Mesa, western Colorado: Geological Society of America Program with Abstracts (Rocky Mountain Sectional meeting).

1999 A.S. Trevena and **R.D. Cole**, Sequence stratigraphy of lacustrine, fluvial and eolian facies in the Tidwell Member of the Morrison Formation, western Colorado: Geological Society of America Program with Abstracts (annual meeting), p. A-284.

1999 **R.D. Cole**, W.C. Hood, and R.B. Scott, Sedimentologic reevaluation, high-resolution gamma-ray log, and landslide hazards of the stratigraphic section at Colorado National

Monument, western Colorado: Geological Society of America Program with Abstracts (annual meeting), p. A-283.

1997 **R.D. Cole**, Milankovitch cycles in the lower Parachute Creek Member of Green River Formation (Eocene), north-central Piceance Creek Basin, Colorado: Geological Society of America Program with Abstracts (annual meeting), p. A-414.

1996 J.S. Klein, P.S. Mozley, A.R. Campbell, and **R.D. Cole**, Geochemical and petrographic correlation of laterally extensive carbonate cemented horizons in the Prairie Canyon Member of the Mancos Shale, western Colorado: Geological Society of America Program with Abstracts (annual meeting), p. A-432.

1996 **R.D. Cole**, R.G. Young, and Willis, G.C., Stratigraphic context of the Prairie Canyon member (new) of Mancos Shale (Upper Cretaceous), western Colorado and eastern Utah: Geological Society of America Program with Abstracts (annual meeting), p. A-124.

1996 M.L. Lambert, **R.D. Cole**, P.S. Mozley, and G.W. Riley, Permeability structure of a highly heterogeneous transgressive marine complex: Tocito Sandstone, New Mexico: American Association of Petroleum Geologists 1996 Annual Convention Official Program (San Diego, CA), p. A-80.

1995 D. Nummedal, S. Gupta, A.G. Plint, and **R.D. Cole**, The falling stage systems tract: definition, character and expression in several examples from the Cretaceous of the U.S. Western Interior, in Hunt, D., Gawthorpe, R., and Docherty, M., conveners, Sedimentary responses to forced regression: recognition, interpretation and reservoir potential: Symposium at University of Manchester, England.

1995 M.L. Lambert, P.S. Mozley, **R.D. Cole**, and G.W. Riley, Facies controlled permeability structure of a highly heterogeneous transgressive-marine complex: Tocito Sandstone, northwest New Mexico, in Swift, D.J.P., Snedden, J.W., and Plint, A.G., conveners, Tongues, ridges and wedges; highstand versus lowstand architecture in marine basins: Society of Economic Paleontologists and Mineralogists (SEPM) Research Conference Program.

1994 **R.D. Cole** and G.E. Moore, Sequence stratigraphy of Cedar Mountain-Dakota interval, western and southern Piceance Creek basin, Colorado: American Association of Petroleum Geologists Annual Convention Program, v. 3, p. 124.

1993 D. Nummedal and **R.D. Cole**, Sequence stratigraphy of the Castlegate and Desert Sandstones, Utah: an alternate view: American Association of Petroleum Geologists Annual Convention Program, v. 2, p. 159.

1992 **R.D. Cole** and C.E. Mullen Reservoir characterization of Tensleep Sandstone (Pennsylvanian-Permian), South Casper Creek field, Natrona County, Wyoming: American Association of Petroleum Geologists Bulletin, v. 76, p. 1257.

1992 D. Nummedal, G.W. Riley, **R.D. Cole**, and A.S. Trevena, The distribution of depositional systems within falling sea level and lowstand systems tracts -- Examples from the Gallup Sandstone: Society for Sedimentary Geology (SEPM) Mid-Year Meeting.

1992 **R.D. Cole** and R.G. Young, Sequence-stratigraphic interpretation of Santonian-Campanian prodelta-plume deposits, eastern Utah and western Colorado: Society for Sedimentary Geology (SEPM) Mid-Year Meeting.

1992 **R.D. Cole**, J.A. Curiale, R.J. Witmer, and E.G. Kauffman, Sequence stratigraphic analysis of the Greenhorn Cyclothem, Northwest New Mexico: Society for Sedimentary Geology (SEPM) Mid-Year Meeting.

1992 **R.D. Cole** and G.J. Daub, Potential methane resources in nahcolitic oil shale: Green River Formation (Eocene), Piceance Creek basin, Colorado: American Association of Petroleum Geologists Bulletin, v. 76, p. 771.

1991 R.J. Witmer, J.A. Curiale, and **R.D. Cole**, Integration of palynofacies, geochemical, and sedimentological data in a sequence stratigraphic framework: progress report on a New Mexico Cretaceous section: American Association of Stratigraphic Palynologists Programs and Abstracts.

1990 **R.D. Cole** and C.E. Mullen, Reservoir characterization of Tensleep Sandstone (Pennsylvanian-Permian), South Casper Creek field, Wyoming: American Association of Petroleum Geologists Bulletin, v. 74, p. 1320.

1989 **R.D. Cole**, J.M. Allmaras, J.P. Zager, and G.E. Moore, Sedimentology, petrology and X-ray mineralogy of Coniacian-Santonian Niobrara Shale, Northeastern San Juan basin, New Mexico: American Association of Petroleum Geologists Bulletin, v. 73, p. 1152.

1987 **R.D. Cole** and R.G. Young, Depositional model for a muddy shelf-sand complex and its relationship to reservoir development: "Mancos B" interval of Upper Cretaceous Mancos Shale, northwest Colorado and northeast Utah: American Association of Petroleum Geologists Bulletin, v. 71, p. 540.

1986 **R.D. Cole** and R.G. Young, "Mancos B" interval of Upper Cretaceous Mancos Shale, Douglas Creek arch, northwest Colorado: A "shelf-sand" complex: American Association of Petroleum Geologists Bulletin, v. 70, p. 1,035

1985 **R.D. Cole** and J.R. Dyni, Origin of dolomite/ankerite in a low-sulfate lacustrine environment: Parachute Creek Member of Green River Formation, Piceance Creek basin, Colorado: Society of Economic Paleontologists and Mineralogists Mid-Year Meeting Abstracts, v. 2, p. 20.

1979 D.L. Boyer and **R.D. Cole**, Total-sulfur content and morphology of iron-disulfide minerals in the Parachute Creek Member of Green River Formation, Piceance Creek basin, Colorado: Geological Society of America Abstracts with Programs, v. 11, no. 6, p. 267.

1979 A.M. Ochs and **R.D. Cole**, Petrology of Tertiary sandstones of the southern Piceance Creek basin, Colorado: Implications for provenance and depositional processes: American Association of Petroleum Geologists Bulletin, v. 63, p. 836.

1979 **R.D. Cole**, M.D. Picard, and A.M. Ochs, Definition of depositional facies of the Parachute Creek Member of Green River Formation, Colorado: Evidence from sulfur isotopes and whole-rock mineralogical data: American Association of Petroleum Geologists Bulletin, v.63, p. 824-825.

1978 **R.D. Cole** and D.L. Boyer, Iron-sulfide mineralogy and morphology in oil shale and marlstone, Green River Formation, Piceance Creek basin, Colorado: American Association of Petroleum Geologists Bulletin, v. 62, p. 505.

1978 A.M. Ochs and **R.D. Cole**, Depositional lithofacies of Parachute Creek Member of the Green River Formation, Douglas Creek arch, Colorado: American Association of Petroleum Geologists Bulletin, v. 62, p. 550.

1977 **R.D. Cole**, G.V. Smith, J.H. Liu, C.C. Hinckly, and M. Saporoschenko, A preliminary Mossbauer spectroscopy study of iron partitioning in oil shale, Green River Formation, Colorado: Geological Society of America Abstracts with Programs, v. 9, no. 5, p. 584.

1977 J.L. Sexton and **R.D. Cole**, Maximum entropy spectral analysis of varved oil shale, Green River Formation, Colorado: Geological Society of America Abstracts with Programs, v. 9, no. 5, p. 649-650.

1977 **R.D. Cole** and J.L. Sexton, Rhythmic variations in oil-shale stratification: Green River Formation, Piceance Creek basin, Colorado: Geological Society of America Abstracts with Programs, v. 9, no. 5, p. 584.

1976 **R.D. Cole** and M.D. Picard, Comparative X-ray mineralogy of nearshore and offshore lacustrine lithofacies, Green River Formation, Piceance Creek basin, Colorado, and eastern Uinta basin, Utah: Geological Society of America Abstracts with Programs, v. 8, no. 6, p. 817-818.

1975 **R.D. Cole**, M.L. Jensen, and M.D. Picard, Sulfur isotope geochemistry of the Green River Formation (Eocene), Piceance Creek basin, Colorado: Geological Society of America Abstracts with Programs, v. 7, no. 7, p. 1031-1032.

1974 **R.D. Cole** and M.D. Picard, Cyclical clastic-carbonate deposition in the lower Green River Formation (Eocene), Douglas Creek arch, Colorado: Geological Society of America Abstracts with Programs, v. 6, no 5, p. 435.

1974 **R.D. Cole** and M.D. Picard, Primary and secondary sedimentary structures in fine-grained lacustrine rocks of the Green River Formation (Eocene), Piceance Creek basin, Colorado: American Association of Petroleum Geologists Bulletin, v. 58, p. 912-913.

1973 **R.D. Cole**, M.D. Picard, M.L. Jensen, and C.R. Williamson, Stable oxygen isotopic composition of carbonate rocks in Green River Formation, eastern Utah and western Colorado: American Association of Petroleum Geologists Bulletin, v. 57, p. 956.

1973 **R.D. Cole**, C.R. Williamson, M.D. Picard, and M.L. Jensen, Fractionation of stable oxygen isotopes in carbonate rocks of the Green River Formation, eastern Utah and western Colorado: Geological Society of America Abstracts with Programs, v. 5, no. 6, p. 472.

CONSORTIUM PROCEEDINGS

2013 **R. Cole**, M. Pranter, A. Attar, R. Sharma, D. Allen, T. Evsan, C. Fenn, J. McFadden, E. Wilcox, and R. Miller, Stratigraphic Architecture and Sedimentology of the Middle and Upper Williams Fork formation Fluvial System: Williams Fork Consortium -- Phase VI, 2013, Final Sponsor Field Trip Guidebook, Energy and Minerals Applied Research Center, Reservoir Characterization and Modeling Laboratory, University of Colorado, Boulder, 57 p.

2011 M. Pranter, **R. Cole**, G. Keeton, A. Attar, T. Evsan, D. Allen, J. McFadden, R. Sharma, E. Wilcox, S. Hilfiker, and S. Schindelar, Stratigraphic Architecture and Sedimentology of the Middle and Upper Williams Fork Formation Fluvial System: Douglas Creek Arch and Piceance Basin, Colorado: Williams Fork Consortium – Phase VI, 2011, Preliminary, Sponsor Field Trip Handout, Energy and Minerals Applied Research Center, Reservoir Characterization and Modeling Laboratory, University of Colorado, Boulder, 7 p.

2010 **R. Cole**, Pranter, M., Aboktef, A., Boulas, P., Gorenc, M., Harper, E., Hlava, K., Keeton, G., Ring, J., Sloan, A., and Taylor, B., Stratigraphic architecture and reservoir characteristics of the Mesaverde Group: application of outcrop-based concepts and statistics to the subsurface, western and northern Piceance Basin, Colorado: Williams

Fork Consortium – Phase V, 2010, Sponsor Field Trip and Research Meeting Guidebook, Energy and Minerals Applied Research Center, Reservoir Characterization and Modeling Laboratory, University of Colorado, Boulder, 92 p.

2008 **R. Cole** and M. Pranter, From rocks to models: outcrop-based analysis and statistics for subsurface characterization of fluvial reservoir geometry and connectivity, Williams Fork Formation, Piceance Basin, Colorado (guidebook): Williams Fork Consortium – Phase IV, 2008, Sponsor Field Trip, Energy and Minerals Applied Research Center, CU-Bolder, 80 p.

2008 M. Pranter, **R. Cole**, N. Sommer, Q. German, B. Binford, and A. Aboktef. From rocks to models: outcrop-based analysis and statistics for subsurface characterization of fluvial reservoir geometry and connectivity, Williams Fork Formation, Piceance Basin, Colorado: Proceedings from the Williams Fork Consortium Phase IV Sponsor Meeting. (CD)

2006 M. Pranter, **R. Cole**, N. Hurley, Z. Riza, M. Kraus, Q. German, H. Panjaitan, and N. Sommer, Stratigraphic architecture, reservoir characteristics, and 3-D outcrop modeling using high-resolution laser imaging (lidar): Williams Fork Formation of the Mesaverde Group, Piceance Basin, Colorado: Proceedings from the Williams Fork Consortium, Reservoir Characterization and Modeling Laboratory, University of Colorado at Boulder, 200p. (CD)

BOOK REVIEWS PUBLISHED (Journal of Sedimentary Petrology, J.S.P. or Journal of Sedimentary Research, J.S.R.)

1999 Terrigenous Clastic Depositional Systems; Applications to Fossil Fuel and Groundwater Resources, by W.E. Galloway and D.K. Hobday: J.S.R., v. 69, p. 795.

1980 Field Description of Coal, by R.R. Dutcher, ed.: J.S.P., v. 50, p. 320-321.

1979 Principles of Isotope Geology, by G. Faure: J.S.P., v. 49, p. 340-341.

1979 Microfacies and Microfossils of the Miocene Reef Carbonates of the Philippines, by A.V. Carozzi, M.V. Reyes and W.P. Ocampa: J.S.P., v. 49, p. 683.

1976 Apatite, by D. McConnell: J.S.P., v 46, p. 262.

1974 Thermodynamics of Rock-Forming Crystalline Solutions, by S.K. Saxena: J.S.P., v. 44, p. 1329-1330.

1974 Stable Isotope Geochemistry, by J. Hoefs: J.S.P., v. 44, p. 971-972.

1974 Strontium Isotope Geochemistry, by G. Faure and J.L. Powell: J.S.P, v. 44, p. 598.

CASSANDRA R. FENTON

ResearchGate Profile: http://www.researchgate.net/profile/Cassandra_Fenton

Google Scholar Profile: https://scholar.google.de/citations?hl=de&user=Kuu7EwwAAAAJ

EDUCATION

MS Geographical Information Science & Systems **2015**

University of Salzburg – Interfaculty Department of Geoinformatics - Z_GIS, Salzburg, AT
Thesis*: A combined approach using FastScape χ-values and ^{10}Be erosion rates to evaluate topographic equilibrium in evolving landscapes: Examples from Namibia and the central Himalaya*

PhD Geology **2002**
University of Utah, Department of Geology and Geophysics, Salt Lake City, Utah, USA
Dissertation: *Pleistocene lava-dam outburst floods, western Grand Canyon, Arizona*

MS Geology **1998**
University of Utah, Department of Geology and Geophysics, Salt Lake City, Utah, USA
Thesis: *Cosmogenic 3-Helium dating of lava-dam outburst floods in western Grand Canyon, Arizona*

BA Geology **1994**

Certificate in Management Studies: Public Policy Analysis **1994**

University of Rochester, Department of Earth and Environmental Sciences
Rochester, New York, USA

TEACHING EXPERIENCE

Assistant Professor in Geology, Colorado Mesa University, Grand Junction, CO 2019 – present

Teaching 12 – 13 credit hours per semester.
Courses taught include:

- GEOL 103 Weather & Climate
- GEOL 105 Geology of Colorado (Developed Course)
- GEOL 111/111L Principles of Physical Geology
- GEOL 113/113L Field-Based Introduction to Physical Geology
- GEOL 204 Computer Applications in Geology (Developed course)
- GEOL 351 Applied Geochemistry

– GEOL 480 Summer Field Camp (one week mapping project)
Quaternary lava flows and faults (San Francisco Volcanic Field, AZ)
GEOL 496 (Topics Course) Climate Change: The Science (Developed Course)
GEOL 497 Structured Research (Supervised research with undergraduate Geosciences and Chemistry Students)

Geology Instructor, Colorado Mesa University, Grand Junction, CO **2016 – 2019**

Teaching 12 – 13 credit hours per semester, plus one week of Summer field camp.
Courses taught include:

– GEOL 103 Weather & Climate
– GEOL 111/111L Principles of Physical Geology
– GEOL 113/113L Field-Based Introduction to Physical Geology
– GEOL 351 Applied Geochemistry
– GEOL 355 Basic Hydrology
– GEOL 496 (Topics Course) Critical Thinking: Calling BS
– GEOL 480 Summer Field Camp (one week)

Workshop / Seminar Instructor, Marie Curie Research and Training Network, **2005 – 2008**

GFZ-Potsdam, Potsdam, DE

Field Course Instructor for Grand Canyon Research River Trip **March 2003**

University of Arizona, Tucson, USA

Co-taught a 16-day geomorphology field course in Grand Canyon. Responsibilities included preparing lectures and teaching/guiding hands-on field projects for graduate-level students and organizing/co-leading a 16-day, 16-person Grand Canyon research river trip

Teaching Assistant, University of Utah, Salt Lake City, USA **1995 – 2002**

Prepared lab lectures, graded labs and homework assignments, organized and participated in field trips, presented in-class lectures, and held office hours and review sessions for students in the following undergraduate and graduate courses: Geochemistry • Earth Materials II (Petrology and Introduction to Groundwater) • Field Methods • Physical Geology • Geology of Utah • Natural Disasters (General Education class) • Architecture of the Earth (General Education class).

Study Skills Support and Note-Taker for Students with Disabilities, **1991 – 1993**

Center for Excellence in Teaching and Learning, University of Rochester, NY, USA

Outdoor Environmental Educator, Maplewood Family YMCA, Rochester NY, USA **1992**

Tutor (Math, Science, Spanish), Town of Webb High Schools, NY, USA **1986 – 1990**

RESEARCH EXPERIENCE

Principal Investigator on the SPICE Project **2015 – present**

Continued involvement in the SPICE Project. Lead author on talks and manuscripts produced as result of ongoing cosmogenic nuclide analyses.

Research Fellow – Principal Investigator on the SPICE Project **2015 – 2016**

University of Cologne, Cologne, DE

Cross-calibration of production rates of cosmogenic ^{3}He, ^{10}Be, ^{14}C, ^{21}Ne, ^{26}Al, and ^{36}Cl in co-existing quartz, olivine, pyroxene, and whole-rock basalt.

Guest Scientist **2010 – present**

Helmholtz-Zentrum Potsdam - Deutsches GeoForschungsZentrum, Potsdam, DE

Cross-calibration of production rates of cosmogenic ^{3}He, ^{10}Be, ^{14}C, ^{21}Ne, ^{26}Al, and ^{36}Cl in co-existing quartz, olivine, pyroxene, and whole-rock basalt.

Scientific Interface Team **2014 – 2015**

ResearchGate, Berlin, DE,

Scientific content management; Level 1 customer support with 24-hour targets; maintaining user satisfaction to ensure growth; online research and data entry; reviewing scientific content; trend identification; communication with supervisor about product feedback.

Research Fellow at NERC-funded Cosmogenic Isotope Analysis Facility (CIAF) **2008 – 2010**

Ex-officio Member of and Secretary to the Steering Committee

for the Cosmogenic Isotope Analysis Facility (CIAF)

at SUERC (Scottish Universities Environmental Research Centre)

University of Glasgow, UK

Designed, planned, lead or participated in, and implemented 11 different projects leading to 13 peer-reviewed journal publications. Co-managed two lab technicians. Helped applicants write proposals to meet Steering Committee criteria, in order to compete for funding at the CIAF, which specializes in cosmogenic ^{10}Be, ^{26}Al, and ^{36}Cl research. Trained users of laboratory facility.

Marie Curie Research Fellow in **CRONUS-EU** **2005 – 2008**

Helmholtz-Zentrum Potsdam - Deutsches GeoForschungsZentrum, Potsdam, DE

Designed and implemented 3 different projects leading to 6 peer-reviewed journal publications. Supervised PhD student. Determined primary calibration of ^{10}Be production rate in Norway. Evaluated production rates of cosmogenic ^{3}He and^{21}Ne in olivine/pyroxene from Pleistocene basalt flows in AZ, USA.

National Academies, National Research Council Research Associate **2002 – 2005**

with U.S. Geological Survey, Tucson, AZ, USA
Studied the timing of Plio-Pleistocene cycles of aggradation and incision in the Colorado River basin in canyons of the Colorado Plateau in Utah and Arizona, which lead to 1 peer-reviewed publication. Managed lab technician.

AWU Summer Intern, Idaho National Engineering and Environmental Laboratories, USA **1999**

Performed infiltration tests in basalt flows to evaluate the chaotic nature of unsaturated flow in fractured rock and managed the resulting data, Idaho Falls, ID. (AWU = Associated Western Universities)

NAGT Summer Intern, U.S. Geological Survey, Denver, CO, USA **1996**

Prepared plant samples from Florida Everglades for analysis of heavy metal concentrations. (NAGT =National Association of Geoscience Teachers)

Clean Laboratory Research Assistant, University of Rochester, USA **1993 – 1995**

Prepared samples for TIMS and ICP-MS using mineral separation processes, acid digestion, and column chromatography.

HONORS, AWARDS, GRANTS, FELLOWSHIPS, AND SCHOLARSHIPS

- Exemplary Faculty Member Merit Award (Colorado Mesa University) **2021**
- Merit Award (Colorado Mesa University) **2020**
- WeCSIP Proposal partially funded by CMU Professional Development Fund ($2391) **2019**
  (**We**stern **C**olorado **S**table **I**sotopes in **P**recipitation Network)
- Exemplary Faculty Member Merit Award (Colorado Mesa University) **2019**
- Merit Award (Colorado Mesa University) **2017 - 2018**
- Lead Scientist **2016 – 2017**
  Cosmogenic Be-10 dating of a major Holocene watershed-damming rockslide in the central Wasatch Mountains, UT, USA: the Little Cottonwood Canyon case study. ANSTO Research Portal, $25,000
- Principal Investigator **2015 – 2017**

*The SPICE Project: The **S**P Flow **P**roduction-Rate **I**nter-Calibration Site for **C**osmogenic-Nuclide **E**valuations*. Peer-reviewed Deutsches Forschungsgemeinschaft (DFG) Research Grant; €202,800

- Natural Environmental Research Council Renewal Grant **2009 – 2014**

co-author; 50% of writing; £2,167,100, over 5 years; for continued funding of the Cosmogenic Isotope Analysis Facility at SUERC, UK

- CRONUS-EU Experienced Researcher in Marie Curie Research Training Network **2005 – 2008**
- National Research Council Research Associate. National Academies, $178,000 **2002 – 2004**
    - Gladys W. Cole Memorial Research Award, Geological Society of America $10,000 **2002**
- Phi Kappa Phi inductee **2002**
- Outstanding PhD Student Award. University of Utah **2002**
- GSA Student Research Grant awarded for PhD research **1999**
- Sigma Xi Student Research Grant awarded for MS research **1998**
- Outstanding MS Student Award. University of Utah **1998**
- Stokes and Eardley Fellowship. University of Utah **1997 – 1998**
- Best Field Geologist Award. Lehigh University Field Camp **1995**
- Bausch & Lomb Scholarship. University of Rochester **1990 – 1994**

ADDITIONAL SKILLS

COMPUTER EXPERIENCE:

- ESRI ArcGIS 10.x, ArcGlobe, ArcGIS Online, ArcGIS for Server, ArcGIS Model Builder
- Open-Source Software: QGIS 2.0 and LandSerf 2.3
- Remote Sensing: ERDAS Imagine/LPS2013, eCognition Developer 9.0
- Databases: SQL, PL/SQL, Oracle Spatial, PhpMyAdmin and MySQL
- Adobe Acrobat 8 Professional, Illustrator CS3 and Photoshop CS3
- Google Docs / Drive; Blackboard; Microsoft Office 2007 & 2008
- Windows 7 and Mac OS X
- Steady and unsteady flood modeling with HEC-RAS and FLDWAV
- Groundwater Modeling System (GMS) including MODFLOW

ANALYTICAL INSTRUMENTATION:

- Noble gas mass spectrometry (MAP 215-50 and VG 5400)
- Ionically coupled plasma mass spectrometry (ICP-MS)
- Electron Microprobe (Cameca SX-50)

- Electronic Total Station (Electronic Theodolite integrated with an Electronic Distance Meter)
- Vacuum systems
- Basic wet chemistry and mineral separation processes

LANGUAGES: Native English speaker; German (B2 CEFR level); some proficiency in Spanish.

PROFESSIONAL ACTIVITIES AND SERVICE

- Co-Chair, Teacher to Teacher (T2T), August 2020 – present
- Organizing Committee Member, Teacher to Teacher (T2T), August 2019 – present
- Committee Member, Retention Committee (Academic Affairs committee), March 2020 – present
- Committee Member, Advising Committee (Subcommittee to Retention Committee), March 2020 – present
- Member, CRM Faculty Focus Group August 2020 – present
- Organizing Committee Member, Student Showcase Planning Committee, August 2019 – June 2020
- Chair, Ad Hoc Committee on Curriculum for Environmental Geology (BS) and Watershed Science minor, August 2019 – present
- Member, Search Committee, Geoscience Program search for Professor in Sedimentology
- Chair, Ad Hoc Committee on Geosciences Website Licensure, 2021– present.
- Member, Ad Hoc Committee on Geographic Information Science and Technology, 2016 – present
- Member, Ad Hoc Committee for Geosciences Scholarship Selection, August 2018 – present
- Participated in Academic Affairs "Faculty Brainstorm" session about covid protocols and faculty questions/concerns (online; July 2020)
- Co-creator, organizer and leader of Annual GeoDay Hike for First Year students, August 2018 – present
- Faculty Sponsor, CMU student chapter of American Association of Petroleum Geologists (AAPG), student geology club, fall 2016 – 2020.
- Faculty host to guest speakers from local community in my introductory geology courses to show connection between geology, our community, and possible career paths / employment opportunities in geosciences
- Recruitment activities for CMU Geosciences
    - Geosciences Representation for First-Year PES Orientation event (August 20, 2021). Toured Geosciences Program labs and classroom space, promoted our program degrees.
    - Worked with President and Regional Directors of the National Earth Science Teachers Association (NESTA) to publish information in their newsletters about CMU Geosciences Program and degrees (including Geosciences Secondary Education degree), Feb-March 2021
    - Mesa Experience PES representative for the Geosciences Program (March 7, 2020). Toured Geosciences Program labs and classroom space, promoted our program degrees.
    - Invited speaker on Climate-Change Panel for the Grand Valley Students United action group (online community-wide meeting; Earth Day, April 2020). Promoted inclusivity of CMU's Geosciences Program and courses we offer covering climate change.

- Invited speaker on Climate Change for an online ESL course (English as a Second Language) for Japanese students at Genesee Community College. Promoted inclusivity of CMU's Geosciences Program and courses we offer covering climate change.
- Digital editor of CMU Geosciences Program website, keeping website current, April 2018 – present https://www.coloradomesa.edu/geosciences/index.html
- Created "Geoscience Resources" webpage, provide information about careers, employment, scholarships, grants, and graduate school to students
- Collaborating with CMU Marketing Department (CMU Now) to publish online articles that highlight student activities and success in CMU Geosciences Program, August 2019 – present
    - Down to earth geology students excel at national conference
    - From CMU to the San Juans: incoming students hike to new heights
    - Etiquette Dinner dishes out research opportunity
    - Organized and staffed Geosciences Program recruitment table in University Center (CMU), 10/29/2019
    - Geosciences Faculty Representative at Department of Physical and Environmental Sciences recruiting event, met with 16 guidance counselors from Colorado state high schools, 11/5/2019

- Active fundraiser to raise money for a rock crusher for the Geosciences Program, 2017 - 2019
    - Organized purchase of rock crusher for Geoscience Program, September 2019
- Invited Speaker, CMU First-Generation Day Kick-off Event, 11/8/19
- Table Host at CMU Annual Etiquette Dinner, 10/29/2019
- Organized and implemented Welcome Cookout for Western Slope Field Conference, September 2019
    - Coordinated with CMU Alumni Association to send invitation to Welcome Cookout to all Geosciences Alumni in our mailing list
- Contributor to CMU Geosciences Program Review (2013 – 2019), conducted alumni survey and compiled results
- Presented to the CMU Physics Program and the Grand Junction Geological Society, 2017: "The SPICE Project: Preliminary cosmogenic nuclide production rates in quartz calibrated at the ~70 ka SP lava flow, AZ, USA."
- Reviewer for *Geology*, *Earth and Planetary Science Letters*, *Journal of Quaternary Science*, *Journal of the Geological Society*, and *Quaternary Geochronology*
- Co-convener of 2004 GSA Annual meeting session: "Geologic History and Processes of the Colorado River"
- Presider at 2003 GSA Annual meeting session: Quaternary Geology/Geomorphology I: Streams and Slopes
    - Contributions to "A Fresh Look at Western Grand Canyon Lava Dams" published in the Boatman's Quarterly Review (issues 16:4, 17:1-3, and 18:1) (Grand Canyon River Guides; http://www.gcrg.org/bqr.php).

SOCIETY AFFILIATIONS

American Association of Petroleum Geologists • American Geophysical Union • Association for Women Geoscientists • Geological Society of America • Geochemical Society • Grand Junction Geological Society

FIELD EXPERIENCE

Basaltic Volcanism, Lava Dams and Outburst Floods

Investigating the volcanic features in the San Francisco and Uinkaret volcanic fields and studying the interaction among Quaternary faulting, basaltic volcanism and fluvial processes and the effects on the Colorado River in western Grand Canyon National Park and on the Owyhee River, Oregon, USA. Includes cosmogenic sampling and mapping of basalt flows, lava dams, and associated lava-dam outburst-flood deposits. MS, PhD, and post-doctoral research. http://www.abc.net.au/science/articles/2008/02/15/2164047.htm

Neotectonics: Normal Faulting

Profiling fault scarps and cosmogenic sampling of displaced surfaces to determine displacement rates on the active Hurricane and Toroweap faults (in AZ and UT), faults in the Volcanic Tableland of the Bishop Tuff (CA), and the Mead Slope fault near Hoover Dam (AZ/NV).

Natural Hazards: Debris Flows

Investigation of historic and Pleistocene/Holocene debris flows at the base of the Santa Catalina Mountains, Tucson, AZ (http://www.azgs.az.gov/hazard_dfcatalinas08.shtml). The study began after five consecutive days of monsoonal storms in July 2006 caused hundreds of debris flows in southeastern Arizona.

Rock Avalanches and Landslides Investigation of and sampling for Optically Stimulated Luminescence, radiocarbon, and cosmogenic-exposure dating of rock avalanches, landslides, and related lacustrine material in Israel, Norway, Argentina, and USA (Grand Canyon National Park, AZ).

Surface Water Hydrology

Mapping effects of controlled Colorado River flood in 1996 on debris fans and rapids in Grand Canyon National Park (http://www.agu.org/books/gm/v110/). Monitoring effects of historic debris-flows on Colorado River channel dynamics. Mapping and unstead flow (HEC-RAS) modeling of Pleistocene outburst-flood deposits on the Colorado and Owyhee Rivers, Arizona and Oregon.

Alluvial Fans and Fluvial Deposits: Fluvial Incision and Aggradation

Dating of Quaternary fluvial and alluvial deposits in the Colorado River basin in Utah and Arizona USA and comparison of ages of aggradation and incision to known ages of Quaternary

climate change. Includes cosmogenic sampling and mapping of alluvial fans in the Black Mountains and Gila Bend Mountains, AZ and river-terrace gravels on the Green, San Juan and Colorado Rivers, UT and AZ.

Investigation of the impacts of abundant Holocene debris-flow activity on the longitudinal profile of the Colorado River in Cataract Canyon, southern Utah; includes cosmogenic sampling and mapping of debris flows and Pleistocene Colorado River terraces.

Pluvial Lakes
Cosmogenic sampling of beach-ridge gravels at and below the Provo shoreline of pluvial Lake Bonneville, Bonneville basin, UT. Cosmogenic sampling of flood deposits related to the catastrophic draining of pluvial Lake Alvord, southeastern OR. Mapping of Pre-Pleistocene pluvial lake deposits in the Lake Lahontan basin, Nevada.

Glacial Geology
Cosmogenic sampling of Pleistocene glacial moraines, outwash terraces, river gravel terraces and bedrock straths in the Andes between northern Patagonia and Mendoza, Argentina. Glaciers and glacial-landforms field trips in Alaska, Germany, and the Swiss Alps.

FEATURED SURFACE-PROCESSES RELATED PUBLICATIONS

Fenton, C.R., 2015. A combined approach using FastScape χ-values and ^{10}Be erosion rates to evaluate topographic equilibrium in evolving landscapes: Examples from Namibia and the central Himalaya. MS thesis. University of Salzburg, Salzburg, Austria.

Youberg, A., Webb, R.H., **Fenton, C.R.,** Pearthree, P.A., 2014. Increased debris-flow activity and magnitude during the Pleistocene-Holocene climatic transition, Santa Catalina Mountains, Pima County, Arizona. Geomorphology 219, 87-102

Fenton, C.R., Pelletier, J.P., 2013. Cosmogenic ^{3}He Age Estimates of Plio-Pleistocene Alluvial-Fan Surfaces in the Lower Colorado River Corridor, Arizona, USA. Quat. Res. 79, 86-99.

Vermeesch, P., **Fenton, C.R.,** Kober, F., Wiggs, G., Bristow, C.S., and Xu, S., 2010. One million year residence time of Namib dune sand measured with cosmogenic ^{10}Be, ^{26}Al, and ^{21}Ne, Nature Geoscience 3, 862-865.

Fenton, C.R., Webb, R.H., Pearthree, P.A., Cerling, T.E., and Poreda, R.J, 2001. Displacement rates on the Toroweap and Hurricane faults: Implications for Quaternary downcutting in Grand Canyon. **Geology** 29, 1035-1038.

PUBLICATIONS (IN REVERSE CHRONOLOGICAL ORDER)

Fenton, C.R., Binnie, S., Dunia, T., and Niedermann, S., Dunai, T., 2021. The SPICE Project: Calibrated cosmogenic ^{26}Al production rates and cross-calibrated ^{26}Al /^{10}Be, ^{26}Al /^{14}C, and ^{26}Al/^{21}Ne ratios in quartz from the SP basalt flow, AZ, USA.

Fenton, C.R., Niedermann, S., Dunai, R., Binnie, S., 2019. The SPICE Project: Production rates of cosmogenic ^{21}Ne, ^{10}Be, and ^{14}C in quartz from the 72 ka SP basalt flow, Arizona USA. Quaternary Geochronology. https://doi.org/10.1016/j.quageo.2019.101019

Hughes, P.D., Fink, D., Rodés, Á., **Fenton, C.R.,** Fujioka, T. 2018. Timing of Pleistocene glaciations in the High Atlas, Morocco: New ^{10}Be and ^{36}Cl exposure ages. Quat. Sci. Rev. 180, 193-213.

Blard, P.-H., Balco, G., Burnard, P.G., Farley, K.A., **Fenton, C.R.,** Friedrich, R., Jull, A.J.T., Niedermann, S., Pik, R., Schaefer, J.M., Scott, E.M., Shuster, D.L., Stuart, F.M., Tibari, B., Winckler, G., Zimmermann, L. 2015. An inter-laboratory comparison of cosmogenic ^{3}He and ^{4}He in the CRONUS-P pyroxene standard. Quat. Geochron. 26, 11-19.

Fenton, C.R., 2015. A combined approach using FastScape χ-values and ^{10}Be erosion rates to evaluate topographic equilibrium in evolving landscapes: Examples from Namibia and the central Himalaya. MS thesis. University of Salzburg, Salzburg, Austria.

Gregory, L.C., Thomas, A.L., Walker, R.T., Garland, R., Niocaill, M., **Fenton, C.R.,** Bayasgalan, A., Amgaa, T., Gatulga, B., Rhodes, A., Xu, S., West, A.J., Schnabel, C., 2014. Combined uranium series and ^{10}Be cosmogenic exposure dating of surface abandonment: a case study from the Ölgiy strike-slip fault in western Mongolia. Quat. Geochron. 24, 27 - 43.

Youberg, A., Webb, R.H., **Fenton, C.R.,** Pearthree, P.A., 2014. Increased debris-flow activity and magnitude during the Pleistocene-Holocene climatic transition, Santa Catalina Mountains, Pima County, Arizona. Geomorphology 219, 87-102

Codilean, A.T., **Fenton, C.R**., Fabel, D., Bishop, P., and Xu, S., 2014. Discordance between cosmogenic nuclide concentrations amalgamated sands and individual fluvial pebbles in an arid zone catchment. Quat. Geochron. 19, 173-180.

Fenton, C.R., Niedermann, S., 2014. Surface exposure dating of young basalts (1-200 ka) in the San Francisco volcanic field (Arizona, USA) using cosmogenic ^{3}He and ^{21}Ne. Quat. Geochron. 19, 87-105.

Fenton, C.R., Mark, D.F., Barfod, D.N., Niedermann, S., Goethals, M.M., Stuart, F.M, 2013. ^{40}Ar/^{39}Ar dating of the SP and Bar Ten lava flows, AZ, USA: Laying the foundation for the SPICE cosmogenic nuclide production-rate calibration project. Quat. Geochron. 18, 158-172.

Fenton, C.R., Pelletier, J.P., 2013. Cosmogenic ^{3}He Age Estimates of Plio-Pleistocene Alluvial-Fan Surfaces in the Lower Colorado River Corridor, Arizona, USA. Quat. Res. 79, 86-99.

Ely, L.L., Brossy, C.C., House, P.K., Safran, E.B., O'Connor, J.E., Champion, D.E., **Fenton, C.R**., Bondre, N.R., Orem, C.A., Grant, G.E., Henry, C.D., and Turrin, B.D., 2012. Owyhee River Intracanyon Lava Flows: Does the River Give a Dam? GSA Bulletin 124, 1667-1687.

Rolfe, C., Hughes, P.D., **Fenton, C.R.,** Schnabel, C., Xu, S., and Brown, A.G., 2012, Paired ^{10}Be and ^{26}Al exposure ages from Lundy: new evidence for the extent and timing of Devensian glaciation in the southern British Isles, Quat. Sci. Rev. 43, 61-73.

Fenton, C.R., Hermanns, R., Blikra, L., Kubik, P.W., Bryant, C., Niedermann, S., Meixner, A., and Goethals, M.M., 2011. Regional ^{10}Be production rate calibration for the past 12 ka deduced from the radiocarbon-dated Grøtlandsura and Russenes rock avalanches at 69° N, Norway. Quat. Geochron. 6, 437-452.

Glasser, N.F., Hughes, P.D., **Fenton, C.R.,** Schnabel, C., and Rother, H., 2011. ^{10}Be and ^{26}Al exposure-age dating of bedrock surfaces on the Aran Ridge, Wales: Evidence for a thick Welsh Ice Cap at the LGM, J. Quat. Geol., doi: 10.1002/jqs.1519.

Hughes, P.D., Braithwaite, R., **Fenton, C.R**., and Schnable, C., 2011. Two Younger Dryas glacier phases the English Lake District: geomorphological evidence and preliminary ^{10}Be exposure ages, Northwest Geography 12, 10-19.

Hughes, P.D., **Fenton, C.R.,** and Gibbard, P.L., 2011. Quaternary glaciations of the Atlas Mountains, North Africa, *in* eds. Ehlers and Gibbard, Quaternary Glaciations - Extent and Chronology, Part IV - A Closer Look, Elsevier, 1065-1074.

Vermeesch, P., **Fenton, C.R.,** Kober, F., Wiggs, G., Bristow, C.S., and Xu, S., 2010. One million year residence time of Namib dune sand measured with cosmogenic ^{10}Be, ^{26}Al, and ^{21}Ne, Nature Geoscience 3, 862-865.

Fenton, C.R., Niedermann, S., Goethals, M.M., Schneider, B., and Wijbrans, J., 2009. Evaluation of cosmogenic ^{3}He and ^{21}Ne production rates in olivine and pyroxene from two Pleistocene basalt flows, western Grand Canyon, AZ, USA. Quat. Geochron. 4, 475-492.

Glasser, N.F., Clemmens, S., Schnabel, C., **Fenton, C.R**., and McHargue, L., 2009. Tropical glacier advances in the Cordillera Blanca, Peru between 15 and 9.5 ka from cosmogenic ^{10}Be dating, Quat. Sci. Rev. 28, 3448-3458.

Goethals, M.M., Hetzel, R., Niedermann, S., Wittmann, H., **Fenton, C.R.,** Kubik, P.W., Christl, M., von Blanckenburg, F., 2009a. An improved experimental determination of cosmogenic ^{10}Be/^{21}Ne and ^{26}Al/^{21}Ne production ratios in quartz, Earth Planet. Sci. Lett. 284, 187-198.

Goethals, M.M., Niedermann, S., Hetzel, R., and **Fenton, C.R.**, 2009b. Determining the impact of faulting on the rate of erosion in a low-relief landscape: A case study using in situ produced ^{21}Ne on active normal faults in the Bishop Tuff, California, Geomorphology 103, 401-413.

Carter, D., Ely, L., O'Connor, J., **Fenton, C.R**., 2006. Late-Pleistocene outburst flooding from pluvial Lake Alvord, southeastern Oregon, Geomorphology 75, 346-367.

Duffield, W., Riggs, N.R., Kaufmann, D., Champion, D., **Fenton, C.R.,** Forman, S., McIntosh, W.C., Hereford, R., Plescia, J., and Ort, M., 2006. Multiple constraints on the age of a Pleistocene lava dam across the Little Colorado River at Grand Falls, Arizona, GSA Bulletin 118, 421-429.

Fenton, C.R., Webb, R.H., and Cerling, T.E., 2006. Peak discharge of a Pleistocene lava-dam outburst flood, western Grand Canyon, AZ. Quat. Res. 65, p. 324-335.

Fenton, C.R., Poreda, R.J., Nash, B.P., Webb, R.H., and Cerling, T.E., 2004. Geochemical discrimination of five Pleistocene lava-dam outburst-flood deposits, western Grand Canyon, AZ. J. Geology 112, 91-110.

Fenton, C.R., Webb, R.H., Pearthree, P.A., Cerling, T.E., and Poreda, R.J, 2001. Displacement rates on the Toroweap and Hurricane faults: Implications for Quaternary downcutting in Grand Canyon. **Geology** 29, 1035-1038.

Fenton, C.R., Webb, R.H., Pearthree, P.A., Cerling, T.E., Poreda, R.J., and Nash, W.P., 2001. Cosmogenic ^{3}He dating of western Grand Canyon basalts: Implications for Quaternary incision. *in* Young, R.A., and Spamer, E.E., eds. The Colorado River: Origin and Evolution: Grand Canyon, Arizona, Grand Canyon Assoc. Mon. 12, 147-152.

ABSTRACTS AND PRESENTATIONS

Fenton, C.R., Niedermann, S., Dunai, T., Binnie, S. 2018. The SPICE Project: Preliminary cosmogenic ^{10}Be, ^{14}C, and ^{21}Ne production rates in quartz from the 72 ka SP lava flow, AZ, USA. Goldschmidt Abstracts.

Fenton, C.R., Niedermann, S., Dunai, T., Binnie, S., Marerro, S. 2016. The SPICE Project: Preliminary cosmogenic nuclide production rates in quartz calibrated at the ~70 ka SP lava flow, AZ, USA. GSA Abstr. Programs, 48. doi: 10.1130/ abs/2016AM-285228.

Fenton, C.R., Niedermann, S., Dunai, T., Binnie, S. 2016. The SPICE Project: Preliminary cosmogenic nuclide production rates in quartz calibrated at the ~70 ka SP lava flow, AZ, USA. In: 3rd Nordic Workshop on Cosmogenic Nuclide Techniques; 8-10 June 2016, Stockholm, Sweden.

Fenton, C.R., Codilean, A.T., Braun, J., Merrall, S. 2015. Combining FastScape χ values and ^{10}Be erosion rates to evaluate topographic equilibrium in evolving landscapes: Exampls from Namibia and the central Himalaya, EOS Trans. AGU Fall Meet. Suppl., (submitted).

Fink, D., Hughes, P.D., **Fenton, C.R.,** 2014. Extent, timing and palaeoclimatic significance of Late Pleistocene glaciation in the High Atlas, Morocco. Geophys. Res. Abstr., EGU2014.

Fink, D., Hughes, P.D., **Fenton, C.R.,** 2012. Extent, timing and palaeoclimatic significance of Late Pleistocene glaciation in the High Atlas, Morocco. In: 21st International Radiocarbon Conf., Jul 2012, UNESCO, Paris.

Hermanns, R., Redfield, T., **Fenton, C.R**., Gosse, J., Niedermann, S., Longva, O., Bøhme, M., 2012. Use of cosmogenic nuclide dating in rockslide hazard assessment in Norway. In: 30th Nordic Geological Winter Meeting Prog. and Abstr.; 9-12 January 2012, Reykjavík, Iceland.

Fenton, C.R., Niedermann, S., 2011. Age-dating of young basalts: A cosmogenic ^{3}He and ^{21}Ne study at Sunset Crater and the SP Flow, AZ, USA. INQUA XVIII Congress Abstr. Progr. #960.

Fenton, C.R., Hermanns, R., Blikra, L., Kubik, P.W., Bryant, C., Niedermann, S., Meixner, A., Goethals, M., 2011. A regional ^{10}Be production rate calibration using two 12 ka radiocarbon-dated rock avalanches at 69° N, Norway. INQUA XVIII Congress Abstr. Progr. #963.

Hughes, P.D., **Fenton, C.R.,** Schnabel, C., Fink, D., 2011. Extent, timing and palaeoclimatic significance of glaciation in the High Atlas, Morocco, INQUA Congress Abstracts with Programs #864.

Niedermann S., **Fenton, C.R.,** 2011. Approaching a consistent set of cosmogenic ^{3}He, ^{21}Ne and ^{10}Be production rates, Geochim. Cosmochim. Acta 75, A1537.

Fenton, C.R., Hermanns, R., Blikra, L., Kubik, P.W., Bryant, C., Niedermann, S., Meixner, A., Goethals, M.M., 2010. Regional ^{10}Be production rate calibration for the past 12 ka deduced from the radiocarbon-dated Grøtlandsura and Russenes rock avalanches at 69° N, Norway. Geophys. Res. Abstr. 12, EGU2010-11702-2.

Codilean, A.T., Fabel, D., **Fenton, C.R.,** Bishop, P., Xu, Sheng, 2009. Grain size dependency of cosmogenic nuclide concentrations in alluvial sediment in an arid zone catchment, Geophys. Res. Abstr.11, EGU2009-5321-1.

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Ely, L.L., Brossy, C.C., Othus, S.M., Orem, C., **Fenton, C.R.,** House, P.K., O'Connor, J.E., Safran, E.B., 2008. Comparison of Natural Dams from Lava Flows and Landslides on the Owyhee River, Oregon, EOS Trans. AGU 89, Fall Meet. Suppl., Abstract H53B-034.

Fenton, C.R., Niedermann, S., Goethals, M., Schneider, B., 2008. Cosmogenic ^{3}He and ^{21}Ne concentrations in olivines and pyroxenes from a Pleistocene basalt flow, western Grand Canyon National Park, Arizona, USA. Geophys. Res. Abstr. 10, EGU2008-A-06167.

Fenton, C.R., Niedermann, S., Goethals, M.M., Schneider, B., Wijbrans, J., 2008. Cosmogenic ^{3}He and ^{21}Ne production in olivine and pyroxene from a Pleistocene basalt flow, western Grand Canyon, AZ. USA. EOS Trans. AGU 89, Fall Meet. Suppl., Abstract V53B-2151.

Niedermann, S., Pilz, P., Goethals, M., **Fenton, C.R.,** Kober, F., 2008. Towards an experimental determination of element-specific production rates for cosmogenic ^{3}He, ^{21}Ne and ^{38}Ar, Geophys. Res. Abstr. 10, EGU2008-A-06808.

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Othus, S., Ely, L., House, P.K., Safran, L., O'Connor, J.E., **Fenton, C.R.**, 2007. Comparison of two landslides and related outburst flood deposits and their effects on river evolution. EOS Trans. AGU 88, Fall Meet. Suppl., #H51E-0808.

Safran, E., Ely, L, O'Connor, House, P.K., J., Grant, G., Brossy, C., **Fenton, C.R.,** 2007. Progressive landslides in uplifted volcanic plateaus: persistent loci of channel perturbation. GSA Abstracts with Programs 39. EOS Trans. AGU 88, Fall Meet. Suppl., #H43H-06.

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Fenton, C.R., Ely, L., House, P.K., Safran, E., O'Connor, J., Grant, G., BeeBee, R., Brossy, C., Carter, D., 2006. Preliminary cosmogenic ^{3}He chronology of Pleistocene/Holocene intracanyon lava flows and outburst-flood deposits in the Owyhee River basin, Oregon. GSA Abstr. Programs 38, 280.

Fenton, C.R., Pelletier, J., 2005. Radiogenic ^{3}He/^{4}He Estimates and Their Effect on Calculating Plio-Pleistocene Cosmogenic ^{3}He Ages of Alluvial-Fan Terraces in the Lower Colorado River Basin, USA. EOS Trans. AGU 86, Fall Meet. Suppl., Abstr. U33A-0006.

Webb, R.H., **Fenton, C.R.,** Howard, K.A., 2005. Age of landslide-dammed lake deposits in central Grand Canyon, Arizona, GSA Abstr. Programs 37, 296.

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Duffield, W., Riggs, N.R., Champion, D., **Fenton, C.R.,** Forman, S., Hereford, R., Kaufmann, D., McIntosh, W.C., Ort, M., Plescia, J., 2004. Revised age of a late Pleistocene lava dam across the Little Colorado River at Grand Falls, Arizona. GSA Abstr. Prog. 36, 431.

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Fenton, C.R., Pelletier, J, Cerling, T.E, 2003. Cosmogenic ^{3}He ages of alluvial-fan terraces on the lower Colorado River, AZ, USA. XVI INQUA Congress, GSA Abstr. Prog. 227.

Fenton, C.R., Cerling, T.E., Webb, R.H., Pearthree, P.A., Poreda, R.J., 2000. New offset rates on the Toroweap and Hurricane faults in western Grand Canyon, Arizona: implications for Quaternary downcutting of the Colorado River. GSA Abstr. Prog. 32, 41.

Fenton, C.R., Webb, R.H., Cerling, T.E., Poreda, R.J., Nash, B.P., 2002. Cosmogenic ^{3}He ages and geochemical discrimination of lava–dam outburst–flood deposits, western Grand Canyon, Arizona. *in* House, K. et al., eds. Ancient Floods and Modern Hazards, Principles and

Applications of Paleoflood Hydrology: Washington, D.C., AGU Water Science and Application Series 4, 191-216.

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Fenton, C.R., Teichmann, F., Cole, R.B., VerStraeten, C.A., Basu, A.R., Baird, G.C., 1995. Pumice fragments in Appalachian Basin bentonites: A petrographic and REE geochemical study. GSA Abstr. Prog., 27, 43.

Curriculum Vitae

Verner C. Johnson, Ph. D.
Professor of Geology and GIS Coordinator
Department of Physical and Environmental Sciences
Colorado Mesa University
Grand Junction, CO 81501

Professional Experience:
My background is teaching in any of my specialized areas including GIS/GPS, geophysics, hydrogeology, computer applications in geology, environmental geology, and engineering geology. I have more than thirty years of geophysical, geological, and GIS/GPS related experiences including proposing and organizing plans for research and teaching, acquiring and interpreting data, problem solving, and preparing verbal and written communication.
Education:

Ph. D., Geology, University of Tennessee at Knoxville, 1975
M.S., Geology, Southern Illinois University at Carbondale, 1970
B.A., Geology, Southern Illinois University at Carbondale, 1967

Research Interests:

I continue to do research project, jointly with BLM, on geophysics data of the Uncompahgre Uplift. For years, my students and I have gathered magnetic data over Pinon Mesa where the strong magnetic anomaly was spotted in 1980 NURE Aerial Magnetic Map. We published posters and papers and will do more in the next few years.
Dr. Hsiang-te Kung of The University of Memphis, Dr. Fei Zhang of the Xinjiang University, China, and I will continue to do more research using GIS and Remote Sensing data of the salinity problems in NW China. Currently we are making plans to do more research and have a paper published in the next few years. In addition, Jad Tahouri of the Ben Abedellah University, Morocco, co-author with us doing GIS/Remote Sensing projects in the Morocco area.
Publications:
Zhang, Fei, Wang, Xiaoping, Kung, Hsiang-te, and **Johnson, Verner Carl**, 2018, "Estimating soil salt content using fractional derivatives and optional spectral indices in the Ebinur Lake Oasis, Northwestern China," Data-Enabled Discovery and Applications, 2:6, https://doi.org/10.1007/s41688-018-0017-2, Springer Publisher.
Wang, Xiaoping, Zhang, Fei, Kung, Hsiang-te, and **Johnson, Verner Carl**, 2018, " New methods for improving the remote sensing estimation of soil organic matter content (SOMC) in the Ebinur Lake Wetland National Nature Reserve (ELWNNR) in northwest China," https://doi.org/10.1016/ j.rse.2018.09.020, Elsevier Publisher.
Zhang, Fei, Haiwei, Zhang, Kung, Hsiang-te, and **Johnson, Verner** C., 2018, "Watershed water quality assessment of Ebinur Lake Basin, Xinjiang, China, based on Weber-Fechner Law,"

(abstract), Geological Society of America Annual Meeting, Indianapolis, Indiana, Geological Society of America Abstracts with Programs. Vol. 50, No. 6, doi: 10.1130/abs/2018AM-322462
Livaccari, Rick, Trumbo, Adam, **Johnson, V. C**., and Feil, Michael, as field trip guides in "Preliminary Structural, and Geochemical Investigations of the Unaweep Canyon Fieldtrip" in Geosciences Students & Alumni 3nd Annual Spring Field Trip, sponsored by CMU Geoscience program, April 23, 2017.
Fei Zhang, Hsiangte Kung, **Verner Carl Johnson**, Bethany Iris LaGrone, and Juan Wang, 2017, "Change detection of land surface (LST) and some related parameters using landsat image: a case study of Ebinur Lake Watershed, Xinjiang, China", Journal of the Society of Wetland Scientists (Springer Publisher), on-line journal, doi.org/10.1007/s13157-017-0957-6, 16 pages (PDF).
Haiyang Yu, Fei Zhang, Hsiang-te Kung, **Verner Carl Johnson**, Colton Spencer Bane, Juan Wang, Yan Ren, and Yue Zhang, 2017, "Analysis of land cover and landscape change patterns in Ebinur Lake Wetland National Nature Reserve, China from 1972 to 2013", Wetland and Ecology and Management Journal (Springer Publisher), on-line journal, DOI 10.1007/s11273-017-9541-3, 19 pages (PDF).
Xiaoping Wang, Fei Zhang, Jianli Ding, Hsiang-te Kung, Aamir Latif, and **Verner C. Johnson**, 2017, "Estimation of soil salt content (SSC) in the Ebinur Lake Wetland National Reserve (ELWNNR), Northwest China, based on a Bootstrap-BP neural network model and optimal spectral indices", Science of the Total Environment (Elsevier Publisher), doi.org/10.1016/j.scitotenv.2017.10.025, (PDF), p. 919-930.
Fei Zhang, Hsiang-te Kung, and **Verner C. Johnson**, 2017, "Assessment of land-cover/land-use change and landscape patterns in the two National Nature Reserves of Ebinur Lake Watershed, Xinjiang, China", Sustainability (MDPI publisher), 22 pages, vol. 9, 724; doi:10.3390/su905o724 (PDF), 22 pages.
Johnson, V. C., Trumbo, Adam, Feil, Michael, and Klaiber, Christian, 2016, "Preliminary Geophysical, Structural, and Geochemical Investigations of the Uncompahgre Plateau in Relations to the Tectonic Implications for the Formation of Unaweep Canyon", presented to the Grand Junction Geological Society monthly meeting, February 17, 2016.
Aslan, Aslan, Cole, Rex, Cooley, Jonathan, **Johnson, Verner**, Jones, Larry, and Livaccari, "Geosciences Students & Alumni 2nd Annual Spring Field Trip: Canyonlands", CMU Geoscience Fieldtrip Guide, April 24, 2016.
Zhang, Fei, Tiyip, Tashpolat, Kung, Hsiang-te, **Johnson, Verner**, Maimaitiyiming, Mathew, Zhou, Mei, and Wang, Juan, 2016, "Dynamics of land surface temperature (LST) in response to land use and land cover (LULC) changes in the Weigan and Kuqa river oasis, Xinjang, China"; Arab Journal of Geosciences, v. 9, p. 499-513.
Verner C. Johnson (invited guest speaker), Adam Trumbo, Michael Feil, Joe Mazza, Alexandra Price, and Marc Fischer, "Preliminary Structural Development of the La Sal Mountains and Uncompaghre Plateau in Relation to the Tectonic Implications from Upper Mantle Tomography" presented orally to the Geology Colloquium at Southern Illinois University Carbondale, Illinois, September 8, 2016.
Johnson, Verner C.; Mazza, Joseph M.; Trumbo, Adam L.; Feil, Michael J.; and Fischer, Marc, "Hypothetical Tectonic Evolution of the LaSal Mountains and the Uncompahgre Plateau Based on Upper Mantle Tomography", Geological Society of America Annual Meeting, Denver, Colorado, poster presented on September 24, 2016.

Trumbo, A.L., Feil, M.J.; **Johnson, V.C.**; Livaccari, R.; Price, A.M.; Mazza, J.M., "Laramide-age Structure, Geochemistry and origin of Unaweep Canyon, northern Uncompahgre Plateau" Geological Society of America Annual Meeting, Denver, Colorado, poster presented on September 28, 2016.

Livaccari, R., Trumbo, A, Feil, M., and **Johnson, V.**, "Laramide Structure of the Northern Uncompahgre Plateau and Origin of Unaweep Canyon, Western Colorado"; presented to the Grand Junction Geological Society monthly meeting, November 16, 2016.

Zhang, Fei, **Johnson, Verner C.**, and Kung, Hsiang-te, "Accurate analysis of multi-spectral bands of Landsat TM images in mapping land surface water information in Ebinur Lake, Xinjiang, China" Abstract, Geological Society of America Annual Meeting in Baltimore, Maryland, November 1-4, 2015

Fei Zhang, Tashpolat Tiyip, **Verner C. Johnson**, Hsiangte Kung, Jianli Ding, Mei Zhou, Yahui Fan, Ardak Kelimu, Ilyas Nurmuhammat, 2014, "Evaluation of land desertification from 1990 to 2010 and its causes in Ebinur Lake region, Xinjiang China", Journal of Environmental Sciences by Springer Publisher, p. 1-16.

Zhang, F., Tiyip, T., Feng, Z. D., Kung, H-T, **Johnson, V. C.**, Ding, J. L., Tashpolat, M, Sawutt, and Gui, D. W., 2013, "Spatio-Temporal Patterns of Land Use/Cover Changes over the past 20 Years in the Middle Reaches of the Tarium River, Xinjiang, China" Land Degradation & Development, Published online in Wiley Online Library (wileyonlinelibrary.com) DOI 10.1002/ldr.2206.

Zhang, Fei, Tiyip, Tashpolat, Ding, Jianli, Kung, Hsiang, **Johnson, Verner**, Sawut, Mamat, Tashpolat, Nigara, and Gui, Dongwei, 2012, "Studies on the reflectance spectral features of saline soil along the middle reaches of Tarim River: a case study in Xinjiang Autonomous Region, China", Environmental Earth Sciences, Environ Earth Sci DOI 10.1007/s 12665-012-2096-y.

Supervision of Student Research/Projects:

King, J. D., 2019, "Magnetic Survey & Geochemical Analysis of Ryan Park-Unaweep Canyon" poster presentation in Showcase and GJ Geological Society (April, 2019).

Mumby, Ryan, 2019, "New mapping of magnetic anomalies using proton precession magnetometers within the northeastern part of the Uncompahgre Plateau" poster presentation in Showcase and GJ Geological Society (April, 2019).

Rice, Robert, 2014, "A Geologic Study of Dakota Formation Exposures in Delta County, Colorado. (Honor thesis faculty advisor)

Benjamin Haveman, Nichole Redden, Clayton Wein, 2013, "A Preliminary Geological/Geophysical Investigation of the Cook Canyon magnetic High, NW Uncompahgre Uplift, Colorado"

Nichole Reddin, Benjamin Haveman, Clayton Wein, 2013, "Preliminary Geological Investigation of a Clataclastic Ridge on Pinon Mesa in Cook Canyon, Uncompahgre Plateau, Western Colorado

Con Trumbull, Stanial Klassert, Nichole Redden, 2012, "A Preliminary geological/Geophysicsl Investigation of the Cook Canyon Magnetic, NW Uncompahgre Uplift, Colorado" (poster presentation in Student Showcase, April 25, 2012 and Grand Junction Geological Society, April 25, 2012 (received outstanding award)

Ryan Baker, 2012, "The Geologic Map of the Grand Valley" (poster presentation in Student Showcase, April 25, 2012 and Grand Junction Geological Society, April 25, 2012)

Andy Cook, 2012, “Does Soil Type Affect Tree Density of Pinon-Juniper Woodlands at Colorado National Monument?” (Poster presentation in Student Showcase, April 25, 2012)
James Coburn, 2012, “Geological and cultural connection between prehistoric Mesa Verde, Colorado and Chaco Canyon, New Mexico” (oral presentation in Student Showcase, April 25, 2012).
Melani Jensen, 2012, “Proposed Kokopelli Extension of the Riverfront Trail” (poster presentation in Student Showcase, April 25, 2012 received outstanding award)
William Wash, 2012, “Preliminary Investigation of Glacial Deposits on Grand Mesa, Colorado” (written report, summer 2012)
Ryan Baker, 2012, “Surficial Geologic Map of the Grand Mesa” (poster posted on the wall in the faculty offices, summer 2012)
Miller, Roger, 2012, “A geologist's guide to the Mesozoic Rocks of Canyonlands and Arches National Parks, Utah” (sponsor, GEOL495, Independent Study Project - summer)
Graham, Jennifer, 2012, “GIS Makes it possible for oil and gas exploration” (sponsor: GEOL 497 Structured Research Project, presented in student showcase)
Smolek, Audra, 2012, “Hydrology of the Grand Mesa” (sponsor: GEOL 497 Structured Research Project, presented in student showcase)

Conference Presentations:

Jad Tahouri, Sadiki Abdelhamid, Karrat L’houcine, Mesrar Haytam, **Verner Carl Johnson**, Zhang Fei, and Hsiang te Kung, 2019, “Using PAP/RAC model and GIS tools for mapping and study of water erosion processes in the Mediterranean environment: Case of the Asfalou watershed (Oriental Rif, Morocco”, oral presentation at the Global Symposium on Soil Erosion, Rome, Italy, May 15-17, 2019). *****Received outstanding certification form Food and Agriculture Organization of the United Nations.
Trumbo, Adam, Feil, Michael, Klaiber, Christian, and **Johnson, V. C.**, 2015, “Structural and chemical analysis of cataclastic mineral occurrences in the eastern portion of Unaweep Canyon, CO.” poster presentation in Rocky Mountain Section of Geological Society of America Meeting, Casper, Wyoming, May 21-23, 2015.
Trumbo, Adam, Feil, Michael, and **Johnson, V. C.**, 2014, “Magnetic Surveying and Geologic Mapping of Eastern Portion of Unaweep Canyon, CO using ArcGIS/GPS”, poster presentation in GeCO in the Rockies Conference, Grand Junction, Colorado, September 22-24, 2014.*
*Voted by attendees for the best poster in student category in GeCO Conference
Bjerk, Stacy and **Johnson, V. C., 2014**, “A Magnetic Survey of Round Mountain, Castle Valley. UT”, poster presentation in GeCO in the Rockies Conference, Grand Junction, Colorado, September 22-24, 2014.
Haveman, Benjamin Ross, Redden, Nichole, **Johnson, Verner C.**, 2013, “A preliminary geological/geophysical investigation of the Cook Canyon magnetic high, NW Uncompahgre Uplift, Colorado”, Poster session at GSA Rocky Mountain Section, 65th Annual Meeting, Gunnison, Colorado, 15 -17 May 2013
Redden, Nichole, Haveman, Benjamin R., Wein, Clayton, and **Johnson, Verner C.,** 2013, “Geological Investigation of cataclastic ridge on Pinon Mesa in Cook Canyon, Western Colorado”, Poster session at GSA Rocky Mountain Section, 65th Annual Meeting, Gunnison, Colorado, 15 -17 May 2013
Baker, Ryan, and **Johnson, Verner**, 2012, “The Geologic Map of the Grand Valley, Mesa County, Colorado, Poster presentation 2012, AAPG-Rocky Mountain Section Meeting, Sept. 9-12, 2012, Hosted by Grand Junction Geological Society.

Other: Grant preparations

I prepared $25,000 grant proposal to purchase new refraction seismometer to the Unconventional Energy Grants in December, 2018, and was approved in April, 2019. Currently the instrument is under order.

I prepared $15,000 grant proposal to purchase new magnetometers to the Unconventional Energy Grants and was approved in March, 2017. New magnetometer arrived in December, 2017.

2005 - 2015: BLM GIS Internship grants. The original grant contract from the BLM, began in January 13, 2005. We have obtained approximately $95,000 since 2005 for student assistants working for BLM. Each semester, two students in the GIS program work for BLM performing tasks that include GIS, GPS, and Remote Sensing. Funds is used to pay salary and benefits for students working on BLM projects.

2006-2008: Took part of the National Science Foundation-Research Experiences for the Undergraduate on "A Field -Based Study of Landscape Evolution of Western Colorado" from 2006-2008

2003 - 2005: Forest Service Internship grants. Similar to the BLM Internship grants. We have obtained approximately $45,000 from the Forest Service to hire one or two students to do GIS projects in the forest service offices in Delta and Grand Junction, Colorado.

Professional Memberships:

American Association of Professional Geologists American Geophysical Union
Society of Exploration Geophysicists
Grand Junction Geological Society
- 3 - Year Consular (2014-2017)
- Past-President (since 1998)
- President (1996)
- Vice _ President (1997)

Zeta-Nu Chapter Sigma Gamma Epsilon
- Faculty Advisor of the CMU Zeta Nu Chapter (1990 - 2011)

Geological Society of America

Advising 2013-Present:

Teacher Licensure Advisor: I advised three earth science teacher licensure majors. Because of my involvement with NCAT, I was best fit to advice students who wish to pursue teaching earth science in secondary schools. I checked their records to be sure they had taken required geology and education courses. I encouraged them to go for “student assistantship” and be lab assistant in any or combination of GEOL111, GEOL113, and GEOL112 labs during the last semester before internship. Purpose was to give them teaching experience so they can be better prepared for EDUC 499, Teacher Internship.

GIS&T Advisor: I advised GIS&T minor and/or Certificate students as to what courses they need to take before completing GIS&T Minor and/or Certificate program. I proposed scheduling of GIS courses they need to take each semester pending on how much time they have left before graduation. I also advised non-students (not enrolled in any other program) as to what they need to take which they can complete all the required courses in one year. I advised more than 20 students going into GIS&T minor or certificate.

Geology Advisor: I advised 34 geology and environmental geology majors.

BLM Internship Advisor: A federal government organization, BLM, has internship contracts with Mesa State College. My responsibility includes finding qualified students and signing payroll forms. I also watch budget to be sure that we are within the budget. I do advice prospect interns to prepare resumes and interview for the BLM positions.

Honors and Awards:

Received Outstanding Teacher Award from Colorado Mesa University (formerly Mesa State College) for the 2002-2003 academic year.

Curriculum Vitae

Dr. Richard F. Livaccari

Education

Ph.D. 1994, University of New Mexico, Albuquerque, NM, Geology
M.Sc. 1980, State University of New York at Albany, Albany, NY, Geology
B.Sc. 1977, University of New Mexico, Albuquerque, NM, Geology/Math

Professional Experience

Mesa State College, Department of Physical & Environmental Sciences, Grand Junction, CO
Full Professor
1997 - current
Responsible for teaching Introduction to Physical Geology, Structural Geology, Mineralogy, Igneous & Metamorphic Petrology, Remote Sensing & Structured Research.

Santa Fe Pacific Gold Corporation, Albuquerque, NM (through GeoTemps in Tucson, AZ)
1996 - 1997
Assistant Geologist
Compiled precious metal production and reserves data in GIS format (for Australia, Papua New Guinea, and Canada). Prepared presentation graphics of geologic data from current exploration projects.

Department of Earth & Planetary Sciences, University of New Mexico, Albuquerque, NM
1994 - 1996
Post-Doctorate Researcher
Conducted paleomagnetic field sampling, mapping and structural analysis of metamorphic core complexes in western Arizona and southeastern California (Harquahala, Harcuvar, Buckskin, and Whipple Mountains). Managed budget ($110,000) of NSF research grant. Supervised undergraduate research assistants. Organized and instructed graduate level courses in Cordilleran tectonics (with Prof. Karl E. Karlstrom).

Department of Earth & Planetary Sciences, University of New Mexico, Albuquerque, NM
1990 - 1994
Teaching and Research Assistant
Prepared and instructed Introduction to Physical Geology labs and performed paleomagnetic experiments.

MagmaChem Exploration, Phoenix, AZ & Evergreen, CO
1985 - 1990
Senior Geologist

Conducted tectonic analysis, regional mineral assessment and compilation of metallic ore production data in the western U.S. and South American Cordilleras. Performed field mapping, mineral sampling, well logging, and evaluation of assay data for mineral exploration projects in central Nevada and western Arizona.

Earth Satellite Corporation, Chevy Chase, MD
1981 - 1984
Staff Geologist

Conducted tectonic analysis and hydrocarbon exploration with Landsat imagery, photogrammetry and field mapping.

GRANTS AND AWARDS

U.S. Geological Survey EDMAP program (Educational Component of the National Cooperative Geologic Mapping Program) 2005-2006 Academic year: "Evaluation of Quaternary-Age Faulting and Laramide-Age Fault Kinematics along the Northern Uncompahgre Plateau, Western Colorado ". $6,375

National Science Foundation, Research Experiences for Undergraduates 2005 to 2007 (co-Principal Investigator): "REU Site: A Field-Based Study of Landscape Evolution in Western Colorado". $344,586

U.S. Geological Survey EDMAP program (Educational Component of the National Cooperative Geologic Mapping Program) 2004-2005 Academic year: "Evaluation of Quaternary Faulting along the East-Central Uncompahgre Plateau, Western Colorado". $6,000

Mesa State College Professional Development Monies (OSC) 2000-2001 Academic year: $450.00 for the purchase of petrographic thin sections for the Geology Program.

Mesa State College Professional Development Monies (OSC) 1999-2000 Academic year: $850.00 for the purchase of a digital camera for the Geology Program.

National Science Foundation proposal entitled (1995): "Footwall deformation and regional crustal structure of 'deep'-type metamorphic core complexes, western Arizona and southeastern California: Evaluation with paleomagnetism" (with Dr. J.W. Geissman; Award # EAR-92-06524 for $160,000)

National Science Foundation proposal entitled (1992): "A paleomagnetic assessment of footwall tilting during large magnitude extensional deformation: A case study of the Miocene South Mountains metamorphic core complex, south central Arizona". (with Dr. J.W. Geissman; Award # EAR-92-05893 for $62,000)

Publications

*White, Jonathan L., **Livaccari, R.,** Hodge, J., and Nelson, M.; "OF-15-14 Geologic Map of the Mack Quadrangle, Mesa County, Colorado." Geologic, 1:24,000. Open File Reports. Golden, CO: Colorado Geological Survey, 2015.*

Livaccari, R. and Hodge J., 2009, Geologic Map of the Fruita Quadrangle, Mesa County, Colorado, Open-File Report 09-04, Colorado Geological Survey Department of Natural Resources Denver, Colorado.

Jessup, M. J., Karlstrom, K. E., **Livaccari**, **R. F,** Connelly, J., Amanda, T., and **Rodgers, S.A., 2005, Complex Proterozoic Crustal Assembly of Southwestern North America in an Arcuate Subduction System: The Black Canyon of the Gunnison, Southwestern Colorado**: The Black Canyon of the Gunnison, southwestern Colorado, *American Geophysical Union Monograph*, Volume 154, p. 21 – 38.

Livaccari, R.F., and Geissman, J.W., 2001, Large-magnitude extension along metamorphic core complexes of western Arizona and southeast California: Evaluation with paleomagnetism: *Tectonics*, v. 20, p. 625 - 648.

Scott, R.B., Harding, A.E., Hood, W.C., Cole, R.D., **Livaccari, R.F.,** Johnson, J.B., and Dickerson, R.P., 2001, Geologic map of the Colorado National Monument quadrangle and the Colorado National Monument, Mesa County, Colorado: *U.S.G.S.*, Geologic Investigations Series, I-2740.

Campbell-Stone, E., John, B. E., Foster, D. A., Geissman, J. W., & **Livaccari, R. F.,** 2000, Mechanisms for accommodation of Miocene extension: Low-angle normal faulting, magmatism, and secondary breakaway faulting in the southern Sacramento Mountains, southeastern California: *Tectonics*, v. 19, p. 566-587.

Livaccari, R. F., Geissman, J. W., and Reynolds, S. J., 1995, Large-magnitude extensional deformation in the South Mountains metamorphic core complex, Arizona: Evaluation with paleomagnetism: *Geological Society of America Bulletin*, v. 107, p. 877-894.

Livaccari, R. F., 1994, Role of extensional deformation in the late Mesozoic and Cenozoic tectonic evolution of the western U.S. Cordillera: A regional tectonic model and paleomagnetic study of the South Mountains metamorphic core complex [Ph.D. dissertation]: *Univ. of New Mexico,* Albuquerque, New Mexico, 103p.

Perry, F. V., and **Livaccari, R. F,** 1994, Isotopic evidence for preservation of lithospheric mantle during the Sevier-Laramide orogeny, western U.S.: Comment and Reply: *Geology*, v. 22, p. 671-672.

Livaccari, R. F., and Perry, F. V., 1993, Isotopic evidence for preservation of lithospheric mantle during the Sevier-Laramide orogeny, western U.S.: *Geology*, v. 21, p. 719-722.

Livaccari, R. F., Geissman, J. W., and Reynolds, S. J., 1993, Paleomagnetic evidence for large-magnitude, low-angle normal faulting in a metamorphic core complex: *Nature*, v. 361, p. 56-59.

Livaccari, R. F., 1991, Role of crustal thickening and extensional collapse in the tectonic evolution of the Sevier-Laramide orogeny, western United States: *Geology*, v. 19, p. 1104-1107.

Livaccari, R. F., Burke, K., and Sengor, A. M. C., 1981, Was the Laramide orogeny related to subduction of an oceanic plateau?: *Nature*, v. 289, p. 276-278.

Livaccari, R. F., 1979, Late Cenozoic Evolution of the western United States: *Geology*, v. 7, p. 72-75.

Recent Papers Presented at Professional Meetings

Bowers, T.C., **Livaccari, R.F.**, Feil, M.J., Trumbo, A.L., 2018, Laramide-Age Faulting & Synkinematic Mineralization in Unaweep Canyon, CO; *Geological Society of America Abstracts with Programs* Annual Meeting in Indianapolis, IN.

Livaccari, R.F., Trumbo, A.L., and Feil, M.J., 2016, Laramide Structure Of The Uncompahgre Plateau Of Western Colorado, *Geological Society of America Abstracts with Programs* v. 48, no. 7.

Trumbo, A.L., Feil, M.J., **Livaccari, R.F.**, Johnson, V.C., Price, A.M. and Mazza, J. M., 2016, Laramide-Age Structure, Geochemistry and Origin of Unaweep Canyon in Northern Uncompahgre Plateau, Colorado, *Geological Society of America Abstracts with Programs* v. 48, no. 7.

Swan, M., Horne, J., **Livaccari, R.,** and Keith, S., 2010, Strato-Tectonic Analysis: A Tectonic Integration Tool Used to Link Complex Orogenic Development of the Western U.S. Cordillera to Hydrocarbon: American Association of Petroleum Geologists Rocky Mountain Section, 59th Annual Rocky Mountain Rendezvous, Durango, CO, June 2010

Livaccari, R.F., 2007, Laramide-Age Left-Lateral Strike-Slip Deformation along The Northern Uncompahgre Plateau, Western Colorado: *Geological Society of America Abstracts with Programs* v. 39, no. 6, p. 195.

Nicole Schoolmeesters, Eric Hawes, Whitney Bonner, John Kelley, Loryn (Wren) Bruce, **Richard Livaccari**, 2007, Laramide-Age Structure Of Little Park Road Monocline, Northern Uncompahgre Plateau, Western Colorado: *Geological Society of America Abstracts with Programs* v. 39, no. 6, p. 307.

Nelson, M., and **Livaccari, R.F.,** 2006, Laramide Strike-Slip deformation along the northern Uncompahgre Plateau, western Colorado: the Bull Canyon-Flume Creek fault system, *Geological Society of America Abstracts with Programs,* Rocky Mt. Section, 58th annual meeting.

Hodge, J. and **Livaccari, R.F.,** 2006, Laramide Strike-Slip deformation along the northern Uncompahgre Plateau, western Colorado: the Cactus Park and Glade Park fault systems, *Geological Society of America Abstracts with Programs,* Rocky Mt. Section, 58th annual meeting.

Nelson, M., Hodge, J. and **Livaccari, R.F.,** 2006, Laramide and Quaternary-Age Faulting along the northern Uncompahgre Plateau, western Colorado, *Geological Society of America Abstracts with Programs,* Rocky Mt. Section, 58th annual meeting, field trip guide.

Livaccari, R.F., and Hodge, J., 2005, Laramide and Quaternary-Age Faulting along the northern Uncompahgre Plateau, western Colorado, *Geological Society of America Abstracts with Programs,* Rocky Mt. Section, 57th annual meeting, field trip guide.

Livaccari, R.F., and Hodge, J., 2005, Laramide and Quaternary-Age Faulting along the Cactus Park-Bridgeport fault of the northern Uncompahgre Plateau, western Colorado, *Geological Society of America Abstracts with Programs,* Rocky Mt. Section, 57th annual meeting.

Jessup, M. J., Karlstrom, K. E., Connelly, J., and **Livaccari**, **R. F.**, 2002, Complex Crustal Assembly of southwestern North America involving northwest and northeast-striking fabrics: The Black Canyon of the Gunnison, southern Colorado, *Geological Society of America Abstracts with Programs*, Rocky Mt. Section, 54th annual meeting.

Livaccari, R.F., Bowring, T.J., Farmer, E.T., Garhart, K.S., Hosack, A.M., Navarre, A.K., Peterman, J.S., Rollins, S.M., Williams, C.A., Kunk, M., Scott, R.B., Unruh, D., 2001, Proterozoic rocks of the Uncompahgre Plateau, western Colorado and eastern Utah:

Livaccari, R. F., Geissman, J. W., and Wawrzyniec, T., 1995, Study of continental extension with paleomagnetism: *Geological Society of America Abstracts with Programs,* v. 27, p. A-68.

Livaccari, R. F., Geissman, J. W., and Reynolds, S. J., 1994, Large-magnitude extensional deformation in the South Mountains metamorphic core complex, Arizona: Evaluation with paleomagnetism: *Geological Society of America Abstracts with Programs*, v. 26, p. 250-251.

Livaccari, R. F., Geissman, J. W., and Reynolds, S. J., 1991, Paleomagnetic evaluation of synkinematic footwall tilting along the Miocene South Mountains metamorphic core complex, Arizona: *Geological Society of America Abstracts with Programs*, v. 23, p. 189.

Livaccari, R. F. and Keith, S. B., 1990, Detailed structural analysis of the southern Cordillera from Trans-Pecos Texas to southwestern California: *Geological Society of America Abstracts with Programs*, v. 22, p. 37.

Keith, S. B., and **Livaccari, R. F.,** 1990, Laramide-age decretion as a cause for mid-Tertiary Cordilleran magmatism and deformation: *Geological Society of America Abstracts with Programs*, v. 22, p. 34.

J. JAVIER TELLEZ
Assistant Professor in Geosciences
Colorado Mesa University
970.248.1663 – jtellez@coloradomesa.edu
LinkedIn: https://www.linkedin.com/in/javier-tellez-49664955/ ORCID Profile: https://orcid.org/0000-0001-8799-6557

Academic Experience

Assistant Professor of Geosciences

Colorado Mesa University, Grand Junction, CO (Current)

- Sedimentology and stratigraphy, Geology of Colorado, Physical Geology, Depositional environments and Historical Geology

Ph.D. in Geosciences

University of Oklahoma, Norman, OK (Spring 2021)

- Dissertation: Integrated characterization of tight siliciclastic reservoirs: examples from the Cretaceous Burro Canyon Formation, Colorado and Mississippian Meramec strata, Oklahoma
- Jon R. Withrow Named Grant, AAPG Foundation Grants-in-Aid
- Society of Exploration Geophysicists / Chevron Student Leadership Grant
- Robert K. Goldhammer Fellowship for Technical Excellence
- Robberson Conference Presentation and Creative Exhibition Travel Grant
- Best Collaborating Internship Project, Baker Hughes
- Advisor: Dr. Matthew J. Pranter

M.S. in Geology

University of Oklahoma, Norman, OK (Fall 2015)

- Thesis: Seismic sequence-stratigraphic framework and architectural-element identification based on attributes and well logs for Tertiary strata at the Rankin Platform sub-basin, North Carnarvon Basin, Australia
- Robert K. Goldhammer Fellowship for Technical Excellence
- COUAA Colombian Alumni Association grant
- Advisor: Dr. Roger M. Slatt

B.S. in Geology

Universidad Nacional de Colombia, Bogota, Colombia (Fall 2008)

- Thesis: Integration of 3-D seismic interpretation and well-log data to evaluate the potential for new development wells in the Matanegra Block, Llanos Basin, Colombia
- Researcher in structural geology – Seed project -National Agency for Hydrocarbons
- Researcher in basin analysis project - Colciencias – National Agency for Hydrocarbons
- Scholarship for Outstanding Performance
- Advisor: Dr. Andreas Kammer

Professional Experience

Geoscience Intern

Baker Hughes, Oklahoma City, OK (Jun-Aug 2018)

- Integrated geological and engineering data with machine learning to analyze drilling performance in the STACK, SCOOP, and Merge areas, Anadarko Basin, Oklahoma

Geology Intern

Pathfinder Exploration LLC, Norman, OK (Feb-Aug 2015)

- Created 3-D geological models to evaluate prospective areas, Anadarko Basin, Oklahoma

Reservoir Geologist

Occidental Oil and Gas, Bogota, Colombia (Jan 2011-Jan 2014)

- Conducted stratigraphic evaluations and provided support for reserves estimation.
- Constructed reservoir models to propose >100 new development wells in the Llanos Basin

Junior Geologist

Occidental Oil and Gas, Bogota, Colombia (Oct 2008-Jan 2011)

- Proposed >50 workovers through geological evaluations to improve reservoir performance
- Provided support for technical meetings with industry partners (Ecopetrol and Repsol)

Geology Intern

Occidental Oil and Gas, Bogota, Colombia (Jan-Oct 2008)

- Generated maps and cross-sections using OpenWorks and Geographix for well prognosis
- Integrated seismic and well data to evaluate the potential for new development wells

RESEARCH

Graduate Research Assistant

Reservoir Characterization and Modeling Laboratory (RCML) University of Oklahoma, Norman, OK (Spring 2016-Present)

- Investigate outcrop to subsurface stratigraphy of tight fluvial sandstones, Colorado
- Generate UAS-based photogrammetry outcrop models for facies interpretation and fluvial architecture definition, Colorado.
- Conduct reservoir characterization and seismic-constrained Modeling of Mississippian strata, STACK Play, Oklahoma

Attribute Assisted Seismic Interpretation (AASPI) Consortium University of Oklahoma, Norman, OK (Spring 2016-Present)

- Identified and quantified parasequences using Expectation-Maximization filter
- Used machine-learning techniques for mapping dolomitic facies in calcareous reservoirs
- Applied deep-convolutional neural networks to estimate porosity from thin-section images

Institute of Reservoir Characterization (IRC)
University of Oklahoma, Norman, OK (Spring 2014-Fall 2015)

- Mapped and correlated the Woodford Shale, Ardmore Basin, Oklahoma
- Interpreted seismic-sequence stratigraphy of deepwater seismic-facies, Australia
- Used Self-Organize-Maps for facies mapping and architectural elements definition
-

Research Geologist

National Agency for Hydrocarbons, Colombia (Fall 2007)
Generated E&P licensing round prospect report for the eastern Cordillera Block, Colombia

TEACHING

Instructor and Co-instructor

Mewbourne College of Earth and Energy, University of Oklahoma, Norman, OK

- Introductory Petroleum Geology and Geophysics (GPHY 3423; required course for Petroleum Engineering majors). Addresses conventional and unconventional petroleum resources, basic sedimentary and structural geology, the petroleum system, source rocks, types of traps and seals, reservoir rock properties, exploration and development methods, basic seismic interpretation, seismic attributes, basic reservoir modeling, and volumetric reserves calculations. Enrollment: ~100 students. Co-instructor for Fall 2016, and 2017. Solely instructor, Fall 2018, Summer 2020.

School of Geosciences, University of Oklahoma and Los Andes University, Bogota, Colombia

- Reservoir Characterization and Modeling – Study Abroad in Bogotá, Colombia (GEOL 4970-5970) introduces concepts and methods of geological reservoir characterization and Modeling. Extensive use of Petrel software. Enrollment: 5 OU students with 30 students from the University of Los Andes and industry. Co-instructed with Dr. Matthew Pranter, Summer 2018

Graduate Teaching Assistant

School of Geosciences, University of Oklahoma, Norman, OK

- Reservoir Characterization and Modeling (GEOL 6970). Introduces concepts and methods of geological reservoir characterization and Modeling. Involves extensive use of Petrel software. Assistant for Colorado field trip to Piceance Basin. Enrollment: 10-25 students from geoscience and petroleum engineering Fall 2018, 2019, Spring 2021.

- Integrated Reservoir Modeling & Simulation (GEOL/PE 6970-902). Concepts and methods of integrated static reservoir modeling and dynamic fluid-flow simulation. Extensive use of Petrel/Eclipse software. Enrollment: 20 students (10 geoscience and 10 petroleum engineering – work in teams). Fall 2016, 2017

- 3-D Reservoir Modeling (GEOL 6970-901). Concepts and methods of 3-D geologic Modeling. Enrollment: 20-25 students from geoscience and petroleum engineering. Spring 2015, 2016.

Universidad Nacional de Colombia, Bogota, Colombia

- Oceanography and Coastal Marine Environments. Introduces concepts of geology, chemistry, physics, climatology, environmental science and biology as they apply to the oceans, Enrollment: 50 students from geoscience and biology. Spring 2005, 2006.

Short Course Teaching Assistant

AAPG Student Expo at the University of Oklahoma, Norman, OK

- 3-D Reservoir Modeling. Introduces basic concepts and methods of 3-D Modeling. Enrollment: 25 students. Spring 2017

SERVICE

Professional Society Service

- 2018-present: Reviewer for SEG journal *Interpretation*
- 2018-present: Reviewer for AAPG bulletin journal
- 2017 Poster judge, AAPG annual meeting, Houston, TX
- Vice President, AAPG Student Chapter, 2016-2017
- Vice President, SEG Student Chapter, 2017-2018 – Summit level achievement

Colombian Geological Society

- 2007-2008 Geonotas Associated Editor

Alumni Society

- 2007-2008 COUAA Colombian Alumni Association

Student Associations

- 2007-2008 COLSA Columbian Student Association. Exchange Students Coordinator Chair

PROFESSIONAL AFFILIATIONS

- American Association of Petroleum Geologists (AAPG)
- Colombian Association of Geologist and Geophysicist (ACGGP)
- Society for Sedimentary Geology (SEPM)
- Society of Exploration Geophysicists (SEG)
- Rocky Mountain Association of Geologists (RMAG)
- Geological Society of America (GSA)

PUBLICATIONS AND POSTERS

- **Tellez, J.,** M. J. Pranter, C. H. Sondergeld, C. S. Rai, J. Fu, H. Han, S. Dang, C. McLain, 2021, Mechanical stratigraphy of Mississippian strata using Machine Learning and seismic- based reservoir characterization and modeling, Anadarko Basin, Oklahoma. Interpretation: Special Issue on STACK Play, Oklahoma

- Ortiz, L., **Tellez, J.J.,** Bedle, H, 2020, Application of unsupervised machine learning

techniques in sequence stratigraphy and seismic geomorphology: A case of study in the Cenozoic deep-water deposits in Northern Carnarvon Basin, Australia, SEG Technical Program Expanded Abstracts 2020, /doi.org/10.1190/segam2020-3424849.1

- Ortiz, L., **Tellez, J.J.,** Bedle, H, 2020, Seismic characterization of a blocky mass transport deposit in the Traella Limestone Formation, North Carnarvon Basin, Australia, Interpretation, vol:8, iss:4

- La Marca Molina, K., Bedle, H., **Tellez, J.,**2020, Seismic attributes and analogs to characterize a large fold in the Taranaki Basin. Interpretation, vol:8 iss:4

- **Tellez, J. J.,** M. J. Pranter, and R. Cole, 2020, Fluvial sequence stratigraphy and architecture of the Burro Canyon Formation, southwestern Piceance Basin, Colorado, Interpretation vol:8, iss:4

- **Tellez, J. J.,** M. J. Pranter, and R. Cole, 2019, UAV-Based Photogrammetry for Facies Architecture and Fluvial Sequence Stratigraphic Definition of the Burro Canyon Formation, Piceance Basin, Colorado, AAPG International Conference & Exhibition, Buenos Aires, Argentina, Aug 2019

- **Tellez, J. J.,** M. J. Pranter, and R. Cole, 2019, Fluvial architecture and sequence stratigraphy of the Burro Canyon Formation using UAV-based outcrop models, southwestern Piceance Basin, Colorado, AAPG Rocky Mountain Section Convention Program, Cheyenne, Wyoming

- Duarte-Coronado, D., **J. J. Tellez,** R. De Lima, K. Marfurt, and R. Slatt, 2019, Deep convolutional neural networks as an estimator of porosity in thin-section images for unconventional reservoirs: SEG Technical Program Expanded Abstracts 2019, doi:10.1190/segam2019-3216898.1

- Cervantes, A, **J. J**. **Tellez**, K. La Marca, 2019, Using machine learning techniques for mapping dolomitic facies in a triple porosity calcareous reservoir. Campeche Sound, Gulf of Mexico, AAPG International Conference & Exhibition, Argentina, Aug 2019

- Sinha, S., Kiran, R., **J. J. Tellez,** and K. Marfurt, 2019, Identification and Quantification of Parasequences Using Expectation-Maximization Filter: Defining Well Log Attributes for Reservoir Characterization: Proceedings of the 7th Unconventional Resources Technology Conference, doi:10.15530/urtec-2019-1023

- **Tellez, J. J.,** M. J. Pranter, and R. Cole, 2018, Application of UAV-based photogrammetry for outcrop characterization of fluvial deposits of the Burro Canyon Formation, Piceance Basin, Colorado: RMAG, The Outcrop, v. 67, no. 3, May 2018

- **Tellez, J. J.,** K. Lewis, S. Clark, R. Cole, M. J. Pranter, and Z. A. Reza, 2018, Exploring multi-scale heterogeneity of braided-fluvial reservoirs: implications for reservoir performance, AAPG Annual Convention & Exhibition, Salt Lake City, UT, May 2018

- **Tellez, J. J.,** R. Slatt, K. Marfurt, 2016. Seismic Facies Classification and Characterization of Deepwater Architectural Elements. A Case of Study, North Carnarvon Basin Australia, AAPG Annual Convention & Exhibition, Houston, TX, Apr 2017

- **Tellez, J. J.,** R. Slatt, 2016, Seismic Geomorphology and Characterization of Deepwater Architectural Elements and Its Applications in 3-D Modeling: a Case of Study, North Carnarvon Basin, Australia, AAPG/SEG Annual Convention & Exhibition, Houston, TX, Sep 2016, Cancun, Mexico.

- **Tellez, J. J.,** 2015. Seismic Sequence Stratigraphy and Architectural Elements for Cenozoic Strata at the Rankin Platform Sub-Basin, North Carnarvon Basin, Australia. Master thesis. The University of Oklahoma, pp. 108

INVITED TALKS / WORKSHOPS

- **Tellez, J. J.,** M. J. Pranter, 2016, Application of UAV-Based Photogrammetry for Outcrop Characterization of Fluvial Deposits of the Burro Canyon Formation, Piceance Basin, GTW, New Opportunities with Drones: New Needs, FAA Rule Changes, New Technologies, Houston, TX, Dec 2016

- **Tellez, J. J.,** M. J. Pranter, and R. Cole, 2017, Application of UAV-Based Photogrammetry for Outcrop Characterization of Fluvial Deposits of the Burro Canyon Formation, Piceance Basin, Colorado, 7TH International Symposium on Hydrocarbon Accumulation Mechanism and Petroleum Resources Evaluation, Beijing, China, Oct 2017

PROFESSIONAL DEVELOPMENT

Professional Short Courses, Workshops, and Field Trips

- Risk Analysis and Decision Making using Crystal Ball. Dr. James Murtha. Oct 5, 2012
- Applied Subsurface Mapping. Sia Agah. SCA Companies Apr 9, 2012
- Core Sedimentology. Timothy Cross. Occidental Petroleum, Apr 04, 2011
- Fundamentals of Basin and Petroleum System Analysis. Alton Brown. Mar 21, 2011 Occidental Petroleum.
- Fundamentals of Geostatistics and its Application in Reservoir Characterization. Tien When Lo. Occidental Petroleum Nov 3, 2010
- Integrated Reservoir Analysis. Dan Hartmann and Jhon Farina. Occidental Petroleum, Sep 08, 2010
- Ferron Sandstone Outcrops in Utah – Field trip, Tom Ryer. Occidental Petroleum, Aug

28, 2010
- Reservoir Characterization of Fluvio-Deltaic systems. Tom Ryer. Occidental Petroleum Mar 9, 2010
- Petroleum Geoengineering. Patrick Corbett. SEG Short Course, Jul 2009
- Seismic Interpretation and Analysis in Thrust Belts. Roberto Linares, Aug 13 – 14, 2007

HONORS AND AWARDS

- 2018 Provost Award of Excellence in Teaching: Certificate of Distinction for top 10 percent of all graduate assistants across campus by student evaluations for courses taught during the Fall 2018 semester, University of Oklahoma

- 2017 ETCS Award for Most Dedicated International Instructor, Graduate College of the University of Oklahoma. Fall 2017 semester, University of Oklahoma

- 2018 Best Collaborating Internship Project, Baker Hughes. Awarded for integrating disciplines to achieve the project objective, Summer 2018, Oklahoma City, OK

- 2018 Second place Award in Poster Presentation: AAPG Student Expo: **Tellez, J. J.,** M. J. Pranter, and R. Cole, 2019, UAV-Based Photogrammetry for Facies Architecture and Fluvial Sequence Stratigraphic Definition of the Burro Canyon Formation, Piceance Basin, Colorado, 2018 AAPG Student Expo, University of Oklahoma, Norman, Oklahoma

- 2018 Second place Award for Poster Presentation: Conoco Phillips Research Symposium, **Tellez, J. J.,** M. J. Pranter, and R. Cole, 2019, UAV-Based Photogrammetry for Facies Architecture and Fluvial Sequence Stratigraphic Definition of the Burro Canyon Formation, Piceance Basin, Colorado 2018, AAPG Student Expo, University of Oklahoma, Norman, Oklahoma

- 2008 First Place Award, intern project at Occidental Oil and Gas: Integration of petrophysical data and 3D seismic interpretation for potential new development wells in Matanegra Block. Cano Limon Field, Colombia

Kerry Riley

Dept. of Physical and Environmental Sciences, Colorado Mesa University
Dept. of Geology, Utah State University
Phone: 303-921-8241 **Email:** wvkerry79@gmail.com

EDUCATION:

Ph.D. (Geology)
2019
Utah State University, Logan, UT
Dissertation: *Quaternary Geomorphology in the Grand Staircase Region of the Colorado Plateau: Understanding Arroyo Cut-Fill Dynamics, Erosion Rates, and Wildfire*
Adviser: Dr. Tammy Rittenour
Committee members: Dr. Joel Pederson, Dr. Patrick Belmont, Dr. Joe Wheaton, Dr. Justin DeRose

M.A. (Hydrologic Science)
2012
Boise State University, Boise, ID
Thesis: *A 14,000-year Record of Fire and Alluvial Fan Deposition Reveals Relationships Among Fire, Climate, Vegetation and Sediment Yields in the Middle Fork Salmon River, Idaho*
Adviser: Dr. Jennifer Pierce
Committee members: Dr. Ben Crosby, Dr. Elowyn Yager

B.A. (Majors: Physical Geography and Environmental Science)
2004
University of Colorado, Boulder, CO

TEACHING EXPERIENCE:

Instructor of Geology – (2018-2021)

GEOL 103 Weather and Climate – Colorado Mesa University

GEOL 104 Oceanography – Colorado Mesa University

GEOL 250 Environmental Geology – Colorado Mesa University

GIST 332 Introduction to GIS – Colorado Mesa University

GEOL 305 Cartography – Colorado Mesa University

GEOL 333 Geology of Canyon Country – Colorado Mesa University

GEOL 402/402L Geomorphology – Colorado Mesa University

GEOL 455/455L River Dynamics– Colorado Mesa University

GEOL 480 Summer Field Camp – Colorado Mesa University

Instructor – (2012-2016)

GEOL 3100 Natural Disasters - Utah State University: Summer - 2015 / 2016 (3 credit, 21 and 19 enrollment)

USU 1010 Connections - Utah State University: Fall - 2013 (1 credit, 18 enrollment)

USU 1010 Natural Connections - Utah State University: Fall - 2014 (1 credit, 31 enrollment)

GEOS 313 Geomorphology, Boise State University: Spring - 2012 (4 credit, 25 enrollment)

Teaching Assistant – (Utah State University, UT)
Course: Geol 1115 Physical Geology Spring 2018 (4 credit, 45 students).
Course: Geol 6800 Optically Stimulated Luminescence Short Course Summer 2013 (3 credit, 9 students

GK-12 National Science Foundation Fellowship - (2010-2011) Boise State University, ID
A teaching collaboration between Boise State University and the Foothills Environmental Education Learning Center integrating scientific research into non-traditional informal education.

PUBLICATIONS AND REPORTS

Riley, Kerry E., et al. "Erosion rates and patterns in a transient landscape, Grand Staircase, southern Utah, USA." Geology (2019).

Riley, K, Pierce, J., and Meyer, G. A., 2015, Vegetative and climatic controls on Holocene wildfire and erosion recorded in alluvial fans of the Middle Fork Salmon River, Idaho. The Holocene, 25(5), pp. 857-871.

Riley, K., 2011, Fire geomorphology: Interactions among climate, fire, and vegetation. Vignette In. Bierman and Montgomery, Key Concepts in Geomorphology. http://serc.carleton.edu/60019.

Riley, K., 2011, Fire geomorphology: Fire-related erosion helps to shape our landscapes. Vignette In. Bierman and Montgomery, Key Concepts in Geomorphology. http://serc.carleton.edu/60020.

Augembaugh, K., Harvey, B., Hayes, J., Kernan, K., Marion, D. A., Peterson, J, Pipkin, A., **Riley, K.,** and Kaye, M.. 2009, Fire on the Mountain. In. Speer, Jim (Ed.) The 19th annual North American Dendroecological Fieldweek: Final Report. pp 14-48.

Augembaugh, K., Harvey, B., Hayes, J., Kernan, K., Marion, D. A., Peterson, J, Pipkin, A., **Riley, K.**, and Kaye, M.. 2009, *Quercus Rubra* Tree Ring Chronology. International Tree-Ring Data Bank. http://www.ncdc.noaa.gov/paleo/treering.html

PUBLICATIONS IN PREPARATION

2021. **Riley, K**., DeRose, J., Rittenour, T., and Pierce, J, Mid-late Holocene climate-fire relationships on the Colorado Plateau, USA. Holocene.

2021. **Riley, K.,** Rittenour, T., Pederson, J., and Belmont, P., Temporal and spatial patterns in paleo-erosion rates in a disequilibrium landscape over 100 ky of climate change. Quaternary Science Reviews.

2021. **Riley, K**. and Rittenour, T., Late Holocene arroyo dynamics in southern Utah: a balance between climate forcing and geomorphic thresholds. GSA Bulletin.

2021. **Riley, K**., Pierce, J., and Hopkins, A., Climate, fires, and debris flows control long-term sediment yields in the Middle Fork Salmon River, Idaho. Geology.

INVITED TALKS

West Virginia University Geology Department Seminar Series (Morgantown, WV - 2017) – "Alluvial Sediments Reveal Relations among Climate, Lithology, Erosion Rates, and Geomorphic Thresholds in the Grand Staircase Region of the Colorado Plateau"

Geological Society of America National Conference (Denver, CO - 2016) – "Using Cosmogenic Nuclides to Understand the Connection between Erosion Rates, Environmental Factors, and Landscape Response"

American Fisheries Association Talk (Boise, ID - 2013) - "Climate, fire, and vegetation change provide primary controls on geomorphic response in the MFSR: Evidence from a 14,000-year record"

PROFESSIONAL DEVELOPMENT AND SERVICE:

STEM fair for high school on the Navajo Reservation in SE Utah (Montezuma Creek, UT – 2018)

Friends of the Pleistocene Field Trip Participant (Moab – 2018)

Ecology Center Seminar Series Committee, Utah State University (2013/2014/2015/2016/2017)
Presented at the Friends of the Pleistocene Field Trip (Salmon and Payette Rivers, Idaho - 2017)

Organized and Led the Friends of the Pleistocene Field Trip (Grand Staircase, southern Utah - 2016)

Preparing for an Academic Career in Geosciences Workshop (Madison, WI - 2015)

Internship at the University of Wyoming (Laramie, WY – 2015) – Cosmogenic Nuclide Berryllium-10 Laboratory

Internship at the University of California Irvine (Irvine, CA – 2015) – Radiocarbon AMS Laboratory

Grant Writing Workshop (Logan, UT – 2013 and 2015)

Sediment Transport Short Course (Logan, UT – 2013)

Optically Stimulated Luminescence Short Course (Logan, UT – 2012)

Software Carpentry Bootcamp (Logan, UT – 2013) – Two-day programming workshop

Friends of the Pleistocene Field Trip Participant (Owyhee's – 2011)

Friends of the Pleistocene Field Trip Participant (Path of the Bonneville Flood – 2011)

GK-12 Presentation Boot Camp (Washington DC - 2011)

EPSCOR National Conference (Coeur d'Alene, ID - 2011) – Student Event Coordinator
Boise Watershed Environmental Education Center volunteer (Boise, ID – 2009 - 2010)
Friends of the Pleistocene Field Trip Participant (Henry Mountains Utah - 2010)

Internship at the University of Arizona Accelerator Mass Spectrometry Lab (Tucson, AZ- 2010)

North American Dendro-ecological Field week (Hampshire College, MA - 2009)

Women's Leadership Conference (Boise, ID - 2009)

Friends of the Pleistocene Field Trip Participant (Lees Ferry, AZ - 2009)

AmeriCorps Member (Gainesville, FL - 2008)
National Interpretive Guide Training and Certification (Syringa, ID- 2005)

AWARDS AND SPECIAL RECOGNITION

– Outstanding Graduate Researcher from Utah State University (2016)

– Outstanding Student Paper Award, American Geophysical Union (2011) - Wildfires, debris flows, and climate: Using modern and ancient deposits to reconstruct Holocene sediment yields in central Idaho.

– EPSCOR Western Consortium Tristate Conference Best Student Poster Award (2011)

– Science in Minute Finalist (2011) – Contest top four finalists: created 90-second video using new technology demonstrating an exploding volcano to grade K-12 students.

– John Montagne Award (2010) – GSA Student Research Grant recipient and award. This monetary award supports research in the field of Quaternary geomorphology.

PROFESSIONAL ORGANIZATIONS AND SERVICE:

Member: Geologic Society of America (2009-2019); American Geophysical Union (2009-2019); Association for Woman Geoscientist (2012-2019); Logan Geological Society (2012-2019); National Association of Geoscience Teachers (2012-2019)

CHAIRED CONFERENCE SESSIONS

Geological Society of America (Denver, CO - 2016)
T60. Quantifying and Interpreting the Role of Climate, Tectonics, and Autogenic Processes in Landscape Dynamics
T179. Quaternary Geochronometers: Applications of Multi- Technique Approaches in Geomorphology and Archeology

Geological Society of America (Baltimore, MD - 2015)
T188. Inside or Out? Investigations into Driving Forces in Fluvial Systems
T189. New Applications of Geochronologic Techniques to Quaternary and Archaeological Settings

American Geophysical Union (San Francisco, CA - 2015)
EP43C. Distinguishing Climate, Tectonic, and Autogenic Drivers in Fluvial Records

GK-12 National Conference (Washington DC - 2011)
The benefits of outdoor learning to STEM curriculums

GRANTS AND FUNDING (~ $40,000 TOTAL)

2017 Utah State University School of Graduate Studies Dissertation Fellowship - **$5000**

2017 Utah State University Center for Women and Gender Scholarship - **$1196**

2016 Association of Women Geoscientist Chrysalis Scholarship – **$2000**

2016 Utah State University Center for Women and Gender Weinshenker Scholarship - **$1000**

2015 NSF Doctoral Dissertation Research Improvement Grant: Use of cosmogenic nuclides to understand relations among climate change, erosion rates, and landscape response in Grand Staircase region of Colorado. - **$16,000**

2015 Utah State University Enhancement Grant – **$4,000**

2015 Utah State University Geology Department Robeson Grant - **$300**

2014 Utah State University Geology Department Springer Memorial Scholarship – **$800**

2014 Utah State University Ecology Center Grant - **$2,500**

2013 Geological Society of America Student Research Grant - **$1,875**

2013 Colorado Scientific Society Grant - **$800**

2013 Geology Department Robeson Grant - **$300**

2010 Geological Society of America Student Research Grant - **$3,500**

CONFERENCE ABSTRACTS AND PRESENTATIONS:

2016. **Riley, K.** Rittenour, T., and DeRose, J., Mid- to Late-Holocene Fire History, Vegetation, and Climate Change in the Grand Staircase Region of the Colorado Plateau, Southwest Utah. American Geophysical Union National Conference (San Francisco, CA) – Poster.

2016. **Riley, K.** and Rittenour, T., Using Cosmogenic Nuclides to Understand the Connection between Erosion Rates, Environmental Factors, and Landscape Response. Geological Society of America National Conference (Denver, CO) – *INVITED* talk.

2015. **Riley, K.**, Cosmogenic nuclides help to understand relations among climate change, erosion rates, and landscape response in Grand Staircase region of Colorado Plateau. Utah State University Student Research Symposium, (Logan, UT) – Poster.

2015. **Riley, K.** and Rittenour, T., Mid-Late Holocene Arroyo Stratigraphy in Southern Utah; Balance between Climate Forcing and Geomorphic Thresholds. American Geophysical Union National Conference (San Francisco, CA) – Poster.

2015. **Riley, K.** and Rittenour, T., Erosion rates influence arroyo cut-fill dynamics in semi-arid catchments draining the Grand Staircase region of Colorado Plateau. Geological Society of America National Conference (Baltimore, MD) - Poster.

2015. **Riley, K.** and Rittenour, T., Mid-late Holocene arroyo cut-fill dynamics: hydro-climate and complex inter-basin response. Geological Society of America National Conference (Baltimore, MD) - Oral.

2015. **Riley, K.** and Rittenour, T., Cosmogenic nuclides help to understand relations among climate change, erosion rates, and landscape response in Grand Staircase region of Colorado Plateau. Utah State University Spring Runoff Conference (Logan, UT) – Poster.

2014. **Riley, K.** and Rittenour, T., The influence of sediment supply on arroyo cut-fill dynamics: a preliminary dataset of catchment averaged erosion rates calculated from in-situ ^{10}Be. American Geophysical Union National Conference (San Francisco, CA) – Oral.

2014. **Riley, K.** and Rittenour, T., Observations of arroyo cut-fill dynamics: a preliminary chronostratigraphy from Johnson Wash, southern Utah. Geological Society of America National Conference (Vancouver, BC) - Oral.

2014. **Riley, K.,** Sedimentary archive of mid-late Holocene arroyo cutting-filling in Johnson Wash, southern Utah. Autogenic Dynamics of Sedimentary Systems Conference (Grand Junction, CO) – Poster.

2013. **Riley, K.** and Rittenour, T., The arroyo problem: A new record of mid-late Holocene cut-fill dynamics in Johnson Wash, southern Utah. Geological Society of America National Conference (Denver, CO) – Oral.

2013. **Riley, K.** and Rittenour, T., Preliminary chronology of Holocene alluviation and arroyo dynamics in Johnson Wash, southern Utah. New World Luminescence Conference (Logan, UT) – Poster.

2011. **Riley, K.** and Pierce, J., Wildfires, debris flows, and climate: Using modern and ancient deposits to reconstruct Holocene sediment yields in central Idaho. American Geophysical Union National Conference (San Francisco, CA) – Oral.

2011. **Riley, K.** and Pierce, J., Debris flows vs. sheetfloods: how fire, vegetation and climate control erosional response in small basins. Geological Society of America National Conference (Minneapolis, MN - 2011) – Poster.

2011. **Riley, K.** and Pierce, J., The role of Holocene climate change and fire-related debris flows on long-term (10^3-10^4) sediment yields in the Middle Fork Salmon River Watershed, in central Idaho. Geological Society of America Regional Conference (Logan, Utah) – Oral.

2011. **Riley, K.** The benefits of outdoor learning to STEM curriculums**.** GK-12 National Conference (Washington DC) – Poster.

2011. **Riley, K.** and Pierce, J., A 10,000-year record of fire activity and fire-related sedimentation in the Middle Fork Salmon River, Idaho**.** EPSCOR Tri-state Consortium Conference (Albuquerque, NM) - Poster and pop-up.
2010. **Riley, K.** and Pierce, J., The role of episodic fire-related debris flows on long-term (10^3-10^4) sediment yields in the Middle Fork Salmon River Watershed, in central Idaho**.** American Geophysical Union National Conference (San Francisco, CA) – Poster.

2010. **Riley, K.** and Pierce, J., Fire frequency and fire-related deposition during the Holocene: a study of alluvial fans in the Middle Fork Salmon River watershed, Idaho. Geological Society of America National Conference (Denver, CO) – Oral.

2010. **Riley, K.** and Pierce, J., Fire history reconstruction and sediment yields in the Middle Fork Salmon River throughout the Holocene**.** Idaho EPSCOR Conference (Boise, ID) - Poster.

2009**. Riley, K.** and Pierce, J., Forests, fire, floods, and fish: nonlinear biophysical responses to changing climate**.** Boise State Day at the Legislature (Boise, ID) – Presented poster.

2009**. Riley, K.** and Pierce, J., Fire history reconstruction and sediment yields in the Middle Fork Salmon River throughout the Holocene**.** Idaho EPSCOR Conference (Moscow, ID) - Poster.

APPENDIX B

Geosciences Library Resources

Library Program Assessment
John U. Tomlinson Library
Colorado Mesa University

Date of Assessment: October 2021

Program under review: **Geosciences**

Description of Program: Students pursuing a degree in the Geosciences programs will develop skills in field, analytical, and computational aspects of the Geosciences, and will produce a project that will require independent research.

Program Level/s: Bachelors

Liaison: Jamie Walker

1. Collection Assessment

   The assessment covers five areas: Reference sources, Monographs, Electronic resources, Periodicals, and Media. The assessment methodology, supporting data and resource lists are included in the Appendices.

   Collection development is the joint responsibility of the Geosciences faculty and the Physical and Environmental Sciences Librarian. Review slips are sent to the faculty each month for their review. They may also recommend titles found in their journal reading, publishers' advertisements, or other sources. Titles recommended are sent to the librarian, who reviews them and sends them on for purchase as funds allow. 288 titles were purchased in the last 5 years distributed per below. The pandemic recently reduced orders, but that is expected to return to normal.

FY 2016/17	FY 2017/18	FY 2018/19	FY 2019/20	FY 2020/21
106	62	64	43	13

   The budget line is also supplemented by the SpringerLink, ScienceDirect (Elsevier), and Oxford e-book collections.

2. Evaluation of the total collection

   a. <u>Strengths</u>

      Journals, books, reports, and maps are all important resources for CMU geoscience faculty and majors. The indexing (particularly GeoRef) and full-text provided by

CMU's database subscriptions provide access to much current scholarship in the field, strengthening the Library's resources for geoscience research. While not extensive, the Library's reference collection supports the need for authoritative concise geoscience information. The Library's e-book collection is strong in the sciences and the geosciences are well represented. E-books on both general and esoteric topics are readily available. The Library's DVD, and Films on Demand collections provide useful resources, especially for general and introductory needs. The circulating geoscience book collection receives regular use and sufficiently supports coursework for undergraduate geoscience majors.

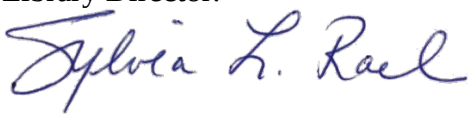
b. Weaknesses

As the geosciences monographic collection is expanded, effort should be made to order additional materials covering subject areas with fewer resources, such as environmental geology or geological education. If there is interest in media materials for more advanced students, additional materials could be purchased for this purpose, as well as to replace older VHS titles.

3. Recommendations

The purchase of newer titles in the geosciences should continue, and the current scope of electronic resources should be maintained.

Library Director:



Date: October 19, 2021

APPENDIX A: Reference sources

The print reference collection provides concise authoritative information with 27 print titles on the general subject of geology. Additional support is provided by online resources.

Sample print and online Reference titles:

Dictionary of ecology (online, 2015)
A dictionary of environment and conservation (online, 2017)
A dictionary of geology and earth sciences (online, 2020)
Encyclopedia of quaternary science (print, online, 2013)
Encyclopedia of sediments and sedimentary rocks (print, 2003)
Glossary of geology (print, 2011)
Oxford companion to the earth (online, 2000)

APPENDIX B: Monographs

Method of analysis: Within the B.S. Geosciences degree, three concentrations are offered: Geology, Environmental Geology, and Secondary Education (Geology). Minors are offered in Geology, Watershed Science, and Geographic Information Systems and Technology. Each of these major terms was searched in the library catalog by date range using the Library of Congress Subject Headings (LCSH). Results are below. All were searched as keywords within the subject index, except for Geographic Information Systems which was an exact subject search.

Age Analysis: For the print/media portion of the collection analyzed by subject in the charts below, about 3% were published since 2010, with about 13% published since 2000. For electronic materials, about 18% have been published since 2010, a third since 2000. For the collection analyzed by classification number, about 5% were published since 2010, with 11% since 2000. Print/Media includes physical items in the collection excluding maps. Maps include both print and e-maps. Electronic materials include all online access materials such as government documents, streaming videos, e-books, or maps. For geology, both current and historical documents are of value.

Geology	Print/ Media	Maps	Elec- tronic
2010-	293	25	1498
2000-2009	611	108	1180
1990-1999	2259	455	630
1980-1989	2046	617	732
1970-1979	1548	1227	634
Pre 1970	3907	1765	1683
TOTAL	10664	4197	6357

Geology – Study and teaching	Print/ Media	Elec- tronic
2010-	5	17
2000-2009	3	19
1990-1999	9	1
1980-1989	3	0
1970-1979	1	0
Pre 1970	2	2
TOTAL	23	39

Environmental Geology	Print/ Media	Elec- tronic

Watershed (as word contained in LCSH)	Print/ Media	Maps	Elec- tronic

2010-	9	114		2010-	115	0	607
2000-2009	14	127		2000-2009	579	9	640
1990-1999	50	22		1990-1999	896	21	307
1980-1989	17	10		1980-1989	391	20	224
1970-1979	8	3		1970-1979	199	30	135
Pre 1970	0	0		Pre 1970	332	6	235
TOTAL	98	276		TOTAL	2512	86	2148

Geographic Information Systems	Print/ Media	Elec-tronic
2010-	13	222
2000-2009	33	107
1990-1999	45	31
1980-1989	3	1
1970-1979	0	0
Pre 1970	0	0
TOTAL	94	361

Another way of analyzing the collection is by LC Classification Number range which examines primarily print books. Highlighted here are sections of the geoscience portions of the LCCN schedule.

Call number ranges	QE Geology	QE 38 Environmental Geology	TC 401-527 Watershed Management and River, Lake, Water-Supply Engineering	G 70.212-70.217 Geog. Inf. Systems
2010-	365	1	14	15
2000-2009	459	2	15	21
1990-1999	529	1	8	14
1980-1989	955	0	19	0
1970-1979	1,563	0	61	0
Pre 1970	3,762	0	59	0
TOTAL	7,633	4	176	50

Recent monographic purchases of geoscience interest:

- Behringer, W., Selwyn, P. E., 2019, **Tambora and the year without a summer, how a volcano plunged the world into crisis**: Cambridge, Massachusetts, Polity Press, 334 p.
- Ikelle, L., Amundsen, L., 2018, **Introduction to petroleum seismology**: Tulsa, Oklahoma, Society of Exploration Geophysicists, 1373 p.
- International Scientific and Professional Conference on Geodesy, Cartography and Geoinformatics, Molčíková, S., 2018, **Advances and trends in geodesy, cartography and geoinformatics**: Proceedings of the Xth International Scientific and Professional Conference on Geodesy, Cartography and Geoinformatics, Demänovská Dolina, Low Tatras, Slovakia, 10-13 October 2017: Leiden, The Netherlands, CRC Press, Taylor and Francis Group, 203 p.
- Julien, P. Y., 2018, **River mechanics**: Cambridge, Cambridge University Press, 499 p.
- Reiners, P. W., Renne, P., Carlson, R. W., Cooper, K. M., Granger, D. E., McLean, N. M., Schoene, B., 2018, **Geochronology and thermochronology**: Hoboken, John Wiley and Sons, 464 p.
- Scheidt, C., Li, L., Caers, J., 2018, **Quantifying uncertainty in subsurface systems**: Washington, D.C., American Geophysical Union, 279 p.
- Smith, A. B., 1994, **Systematics and the fossil record, documenting evolutionary patterns**: Oxford, Blackwell Science, 223 p.
- Treolar, P. J., Searle, M. P., 2019, **Himalayan tectonics, a modern synthesis**: London, The Geological Society, 669 p.
- Wagner, E. L., 2020, **After the blast, the ecological recovery of Mount St. Helens**: Seattle, University of Washington Press, 239 p.
- Willgoose, G., 2018, **Principles of soilscape and landscape evolution**: Cambridge, Cambridge University Press, 324 p.

As a partial government depository, the Library also makes available a large number of federal documents. For the geosciences, included are those published by a variety of governmental agencies including the U.S. Geological Survey. These are available in a variety of formats with most recent documents online.

APPENDIX C: Electronic Resources

Indexes/Databases: Two databases were selected for analysis.

Academic Search Complete: A general subject academic journal database that contains over 100 journals related to the geosciences. Coverage goes back to the late 1960s.

GeoRef: A geosciences specific database containing over 4 million references with coverage back to 1666. GeoRef is an index only, and does not natively contain full text, although linked full text is often available.

Journal Articles:

Subject searches for some of the topics to be covered in the courses for this program were done in Academic Search Complete (ASC) and GeoRef databases to illustrate available resources. The journal literature is rich in articles for this program. The chart below shows a sampling of the resources available.

Subject/Topic	ASC Total Articles	ASC 2010- Articles	ASC 2010- Peer reviewed	ASC 2010- Peer reviewed, full-text	GeoRef Total Articles	GeoRef 2010- Articles	GeoRef 2010- Articles w/ Linked Full Text
Geology	78,114	47,107	44,082	35,868	793,419	26,468	12,558
Geology w/ Education	682	371	237	162	13, 652	1,912	639
Environmental geology	416	290	234	163	50,888	537	205
Watershed	28,844	22,758	21,606	17,005	21,565	5,608	3,658
Geographic Info. Systems	21,329	15,605	14,476	11,472	32,402	9,207	5,257

Other Databases

Other databases of possible interest include Science Direct and Wiley.

APPENDIX D: Periodicals

Many geoscience journal titles which formerly were held in print have moved to online access and are maintained through individual subscriptions, or are contained in science databases such as ScienceDirect (Elsevier), Wiley, or Academic Search Complete. There also remain a number of print only titles. The following titles highlight available journals and include some CMU former print titles now online.

AAPG Bulletin
American Mineralogist
Annual Review of Environment and Resources
Economic Geology
Engineering and Mining Journal
EOS
Geological Society of America Bulletin
Geology
Geomorphology
Geophysics
Geoscience Canada
Groundwater
Groundwater Monitoring and Remediation
Journal of Geology
Journal of Sedimentary Research

Mineralogical Record
Mining Magazine
Mountain Geologist
Oil and Gas Journal
Water Well Journal
Zeitschrift fur Geomorphologie

A search of the subject "geology" in our Journal Finder retrieved 230 full-text journal titles. CMU students and faculty have a large number of quality titles from which to choose.

APPENDIX E: Media

The Library holds physical DVDs and VHS, and also subscribes to Films on Demand (FoD), a streaming video service from Films Media Group. Films on Demand includes educational videos, documentaries, and PBS publications. Links to streaming media can be inserted into D2L to facilitate viewing. A subject search of "geology" in the library catalog brings up over 300 titles, most of which are available by streaming online. Most streaming materials are introductory or intermediate in nature, although some may be appropriate for more advanced students. Some titles that might be appropriate for this program are:

Asthenosphere (4 min., FoD, 2010)
Bushveld complex (30 min., VHS, 1982)
Continental deformation creating the Basin & Range (8 min., FoD, 2012)
Earth revealed (840 min. on 7 DVDs, 1992)
Earth's changing surface (33 min., FoD, 2013)
Extensional tectonics (23 min., VHS, 1987)
Geologic time (18 min., FoD, 1999)
Lighting the frontier, the story of Colorado's Florence oil field (71 min., DVD, 1988)
Metamorphic rocks (15 min., FoD, 1999)
Mountains and mountain-building processes (25 min., FoD, 2012)
The Rockies (45 min., FoD, 2011)
Saving the Dead Sea (52 min., FoD, 2019)
Watershed revolution (30 min., FoD, 2014)

APPENDIX F: Additional Resources

Journal literature not available through Colorado Mesa University, including those titles not available because of publisher embargo, can be provided by the Interlibrary Loan Department. The average amount of time it takes to fill an article request is 12 hours.

Physical items such as books and DVDs not owned by Colorado Mesa University can be borrowed from other libraries within the state or region through programs such as Prospector, and when necessary, throughout the world. Items from regional libraries typically arrive in 3-5 business days.

APPENDIX G: Research Instruction and Guidance

Librarians provide instruction on how to find, use, and cite materials. They can customize instruction for the specific topic at hand, including the intricacies of finding materials in a particular subject area. Sessions can be introductory or advanced in nature. Instruction can

be provided in the regular classroom, in the library classroom, or remotely. Customized web materials can also be created to guide students to use and discover appropriate resources, which can be embedded in D2L.

Students may receive personal assistance from professional degreed librarians through the Research Help Desk. The desk is staffed most hours the library is open. Help is available in-person, via telephone, email, and 24/7 chat.

APPENDIX C

Geosciences Curriculum Map

Appendix IV: Geosciences Curriculum Map, AY2021

Course GEOL	SLO1 Special Knowledge	SLO2 Field Data Collection	SLO3 Lab Data Collection	SLO4 Technology	SLO5 Writing	SLO6 Oral Comm
100 Survey Earth Sci						
103 Weather & Clim						
104 Oceanography						
105 Colorado Geol						
106 Dinosaurs						
107 Nat Hazards						
111 Phys Geol	X					
111 Phys Geol Lab	X	Y	Y			
112 Historical	Y					
112L Hist Lab	Y	Y				
113 Field Physical	X					
113L Field Phys Lab	X	Y	Y			
202 Field Studies	Y	X				
204 Comp Apps	Y	Y		X	X	X
250 Environ Geol	Y	Y			Y	Y
301 Structure	Y					
301L Structure Lab	Y	Y	Y	Y		
331 Mineralogy	Y		Y			
331L Mineralogy Lab	Y	Y	X			
333 Canyon Country	Y					
340 Petrology	Y					
340L Petrology Lab	Y	Y	Y			
351 Geochem	Y			Y		
355 Hydrology	Y		Y		Y	
359 Survey Energy	Y					X
402 Geomorph	Y				Y	Y
402L Geomorph Lab	Y	Y	Y	Y	Y	Y
404 Geophysics	Y					
404L Geophys Lab	Y	Y	Y			
415 Ground water	Y		X			
415L GW Lab	Y	Y	X	Y	Y	Y

444 Sedimentology	**Y**		**Y**			
444L Sed Lab	**Y**	**Y**	**X**	**Y**	**Y**	**Y**
455 River Dynamics	**Y**					
445L River Dyn Lab	**Y**	**Y**	**Y**	**Y**	**Y**	
480 Field Camp	**Y**	**X**			**Y**	
490 Sr Seminar	**X**				**X**	**X**

X – denotes part of current Assessment Plan; Y- denotes SLO is completed but not assessed.
X – denotes part of current Assessment Plan but data has yet to be collected.
X - denotes course will not be used for assessment after this reporting period.
NOTE: New CMU-wide SLO's #7 and #8 related to social responsibility and information literacy were not collected during the reporting period.

APPENDIX D

Geosciences Assessment Report

COLORADO MESA UNIVERSITY 2013 – 2021 Assessment Results
Program Outcome and Assessment Plan Template

Program Name: Geosciences

Date: 8/30/21

Program Outcomes	Courses/Educational Strategies Indicate if outcome is Beginning(B), Developing(D) or Advanced(A)	Assessment Method(s)	Time of Data Collection/ Person Responsible	Results of Assessment	Actions Taken
Outcome #1 Articulate the fundamental knowledge base and ideas of the major fields of geoscience (specialized skills in geoscience)	GEOL 111: Physical Geology (B)	**What:** Geology Assessment Exam **How:** Delivered as the final exam in GEOL 111	**Who:** All professors teaching GEOL 111 **When:** As the final exam for every GEOL 111 section in all semesters.	**Results:** Fall & Spring 2013 -2021: (850 students in 23 sections) Avg.: 76.0 % Avg. of Med.: 76 % Mean of Top 5 %: 96.5 % Mean of Bot. 5%: 49% **Key Findings:** Results are encouraging, but could be higher. **Conclusions:** Students in these courses are performing at	**Action:** No action will be taken at this time, but the results will be reassessed after more data are collected. **Re-evaluation Date:** Nov 2021

				a consistent level.	
	GEOL 113: Field-based Physical Geology (B)	**What:** Geology Assessment Exam **How:** Delivered as the final exam in GEOL 113	**Who:** All professors teaching GEOL 113 **When:** As the final exam for every GEOL 113 section in all semesters.	**Results:** Fall & Spring 2014 - 2021: total 428 students in 20 sections) Avg.: 80 % Avg. of Med.: 85% Mean of Top 5 %: 97% Mean of Bot. 5%: 41% **Key Findings:** Students in this course are performing very well. **Conclusions:** Students continue to demonstrate solid learning performance in this course.	**Action:** Continue what we are doing in this course, the data indicates that the students are learning the required material. **Re-evaluation Date:** Nov 2021
	GEOL 490: Seminar (A);	**What:** Geology Exit Exam **How:** Seniors are required to take this test before they can graduate	**Who:** The CMU Testing Center will administer the test, and a spring semester GEOL 490 instructor will collect the results.	**Results:** Spring 2014 – Spring 2021 (100 students in 8 sections) Avg.: 78 % Median: 78%	**Action:** None at this time. **Re-evaluation Date:** Nov 2021

			When: Seniors will take this test during the semester before they graduate, and the results will be collected at the end of every spring semester.	Mean of Top 5 %: 89% Mean of Bot. 5%: 62% **Key Findings:** A majority of students are scoring 65% or better. **Conclusions:** None at this time	
Outcome #2 Collect and interpret geoscience field data (problem solving skills)	GEOL 202: Introduction to Field Studies (D);	**What:** The final project, which is a geologic field mapping project. **How:** Delivered as the final project for GEOL 202. The students will be assessed based on the accuracy of their geologic mapping (50 pts), the accuracy of the accompanying cross section (20 pts), the quality of the field observations recorded in field notebooks (30 pts).	**Who:** All professors teaching GEOL 202 **When:** The final field mapping project for every GEOL 202 section in all semesters.	**Results:** Spring 2013 - Spring 2021 (total of 122 students in 12 sections) Average score: 87% Median: 90% Mean of Top 5 %: 98% Mean of Bot. 5%: 62% **Key Findings:** 95% of students scored >70% on the final mapping project.	**Action:** None at this time. **Re-evaluation Date:** Nov 2021

				Conclusions: Our goal was to have at least 80% of the students score >70% on the final mapping project, so we achieved our goal.	
	GEOL 480: Summer Field Camp (A)	**What:** Six week-long mapping projects **How:** Delivered as weekly final projects. The students will be assessed based on the accuracy of their geologic mapping (50 pts), the accuracy of the accompanying cross section (25 pts), the quality of the field observations recorded in field notebooks (25 pts).	**Who:** All professors teaching GEOL 480 **When:** The mapping projects are done each time this required class is conducted, (alternate Summer Semesters).	**Results:** Summers 2014-2021 (88 students in 8 sections) Avg Grade: 86% Median: 87% Mean of top 5%: 95% Mean of bottom 5%: 51% **Key Findings**: 95% of students have earned a cumulative score of at least 70% on these projects. **Conclusions**: None at this time	**Action**: None at this time. **Re-evaluation Date:** Nov 2021

Outcome #3 Collect and interpret geoscience laboratory data (problem solving skills)	GEOL 331L Crystallography & Mineralogy Lab (D)	**What:** Throughout the semester the students are expected to identify unknown mineral specimens. They are also expected to collect minerals in the field as part of a mineral collection that they turn in at the end of the semester for lab credit. **How:** Students use textbook reading materials on the physical properties of minerals and lectures on same. In the lab students are given about 30 unknown mineral specimens every two weeks. Students must use the physical properties of minerals such as crystal form, hardness, cleavage, twinning, color, etc. to identify these minerals. In the field, students must collect and identify minerals based on their	**Who:** All professors teaching GEOL 331L **When:** The mineral collection project and lab exams are done each time this required class is conducted, (every Fall Semester).	**Results:** The overall class average should exceed 70 points (total = 100 points); i.e., a minimal "C" grade Fall 2014 – Fall 2020: 92 students in 7 sections Avg Score: 84% Median: 87% Mean of top 5%: 100% Mean of bottom 5%: 50% **Key Findings:** Overall class average score exceeded 70%. Students are performing very well in this course **Conclusions:** None at this time	**Action:** None taken at this time. **Re-evaluation Date:** Sept 2021

		physical properties for use in their mineral collection that they turn in at the end of the semester.			
	GEOL 444/444L: Sedimentology and Stratigraphy and Lab (A)	**What:** A final project that involves interpretation of fluvial depositional systems using information presented in lecture (GEOL 444) coupled with a six to eight hour field exercise (GEOL 444L) where data are collected on an ancient fluvial sequence at Riggs Hill near Grand Junction. **How:** In lecture (GEOL 444), students are given reading materials on the spectrum of fluvial depositional systems, coupled with detailed lectures on same. In the field (GEOL 444L), students must generate sedimentologic	**Who:** All professors teaching GEOL 444/444L **When:** The final lecture/lab project is done each time this required class is conducted, (every Spring Semester).	**Results**: Fall 2013 & Spring 2021: 86 students in 7 sections Scores for Rigg's Hill Project: Average: 91% Median: 91% Min: 81% Max: 96% **Key Findings**: Students are performing exceptionally well on this project **Conclusions:** None at this time	**Action**: None at this time **Re-evaluation Date:** Nov 2021

		data (sandstone-body thickness, lithofacies types, stratal surfaces, paleocurrents, and three-dimensional architecture) on a fluvial complex at the Jurassic-Cretaceous boundary. Students are required to use their field data to interpret the genetic type of the sandstone body based on the materials presented in lecture and the reading assignments. Students are required to write a brief report discussing their data and interpretations. This exercise is worth 100 points; breakdown is as follows: accuracy of sedimentologic data collected in field (50 points), quality of final report (40 points), and neatness (10 points).			
	GEOL 415/415L Intro to Ground Water and Lab (A)	**What:** Lab exercises require that student collect lab data from a variety of	**Who:** All professors teaching GEOL 415/415L	**Results:** Spring 2014 (8 students, one section)	**Action**: None at this time

		samples, interpret the data and prepare a written lab report. **How:** Required formal written lab report as part of the lab grade	**When:** The lab report is based on three data-collection labs in the middle of the semester (every other Spring Semester)	No additional data has been provided. Average: 84% **Key Findings:** 100% of students scored >70% **Conclusions:** None at this time	**Re-evaluation Date:** Nov 2021
Outcome #4 Use technology (e.g. computer software) for evaluating quantitative geoscience data (technology skills)	GEOL 204: Computer Applications in Geology (B)	**What:** The final projects, which are computer-generated geologic maps and written report. **How:** Students are required to develop computer skill in the geologic-related problems and utilize the following software: Excel, PowerPoint, and ArcGIS. The final project includes both subsurface geologic maps (well location map and contour maps) of the Dakota Group from the	**Who:** Geology professor teaching GEOL204 **When:** During every section of GEOL 204 which is delivered every semester. Students will take GEOL 204 in either fall or spring during their sophomore year.	**Results:** Goal: The class average should exceed 70 points (total = 100 points); i.e., a minimal "C" grade Fall 2013 - Spring 2021; Total of 92 students in 13 sections Class Average: 87% Class Median: 88% Mean of top 5%: 95% Mean of bottom 5%: 61%	**Action:** None at this time **Re-evaluation Date:** Nov 2021

		petroleum well data in ArcGIS and five-page written report. The students will be assessed based on the accuracy of their geologic maps (60 pts), the quality of the petroleum information (location, depth, and production history) in Excel (10 pts), and written report which includes abstract, introduction, production history, data gathering, computer generation, and analysis (30 pts)		**Key Findings:** All sections had class averages > 70% on the final project.	
Outcome #5 Write an effective report on a geoscience study (communication skills)	GEOL 490: Seminar (A)	**What:** Written report at the end of the course. **How:** This report will be 15 pages (not including figures and tables), and will cover independent research completed during GEOL 490. This project will be assessed using a rubric that rates students on a scale of 1 – 5 for	**Who:** The GEOL 490 instructor. **When:** During every section of GEOL 490, which is delivered every spring semester.	**Results:** Spring 2014 – Spring 2021: 100 students in 8 sections Depth of research (out of 5 possible points): 4.2 Appropriate Methods (out of 5 possible points): 4.4 Organization (out of 5	**Action:** No action has been taken because of the very limited data. **Re-evaluation Date:** Nov 2021

		the following categories: 1) depth of research/content & analysis; 2) appropriateness of methods and approach, 3) organization and professionalism of the report, and 4) clarity of writing and proper use of grammar and terminology.		possible points): 4.3 Technical Writing (out of 5 possible points): 4.3 **Key Findings:** 90% students scored a "4" or higher in two of the four categories. **Conclusions:** Students are performing very well in this course.	
Outcome #6 Demonstrate an effective oral presentation on a geoscience study (communication skills)	GEOL 490: Seminar (A)	**What:** Oral presentation at the end of the course. **How:** This presentation will last 15 minutes and will cover independent research completed during GEOL 490. In addition, 5-10 minutes of questions by peers and instructor will follow the presentation. This project will be assessed using	**Who:** The GEOL 490 instructor. **When:** During every section of GEOL 490, which is delivered every spring semester.	**Results:** Spring 2014 – Spring 2021: 100 students in 8 sections Depth of content (out of 5 possible points): 4.2 Quality of Presentation (out of 5 possible points): 4.3 Quality of Presentation Materials	**Action:** None at this time **Re-evaluation Date:** Nov 2021

		a rubric that rates them on a scale of 1 – 5 for the following categories: 1) depth of content & analysis; 2) quality and professionalism of presentation including organization and preparedness, 3) quality of power point slides including their clarity and depiction of appropriate material and grammar, and 4) ability to answer questions.		(out of 5 possible points): 4.5 Ability to Answer Questions (out of 5 possible points): 4.4 **Key Findings:** 92% of students in each section scored a "4" in two of the four categories.	
	GEOL 359: Survey of Energy Resources (A)	**What**: An oral presentation with handout at the end of the course. **How**: Students choose a fossil-energy topic early in the semester and do research for approximately two months. During the last 1-2 weeks of the class, each student makes a 20 minute oral presentation using slides, videos, transparencies, or PowerPoint on the topic,	**Who**: All professors teaching GEOL 359 **When**: Each time the class is conducted (Fall Semester, on alternating years).	**Results:** Fall 2014 (6 students, one section) Average: 88.0% Median: 89.2% **Key Findings:** **Conclusions:**	**Action:** None at this time. **Re-evaluation Date:** no data after 2016

		followed by five minutes of questions. A handout (with abstract) summarizing their presentation is also provided to the other students and professor. Evaluation involves input from fellow students (peer review) and the professor. A total of 100 points (equivalent to one exam) are tied to the project based on overall effort (30 points),			

APPENDIX E

Alumni Survey of Geosciences Graduates

Alumni Survey Results for Geosciences Graduates - 2019

(n = 20)

Overall, how satisfied are you with your CMU education?

	#	%
Very Satisfied	11	55.0
Generally Satisfied	9	45.0
Ambivalent	0	0.0
Generally Dissatisfied	0	0.0
Very Dissatisfied	0	0.0

While a student, about how often did you have conversations with faculty outside of class?

	#	%
Never	0	0.0
Rarely (1-2 times per	0	0.0
Occasionally (3-5 times per semester)	2	10.0
Often (once every two weeks)	6	30.0
Very Often (at least once a week)	12	60.0

Would you encourage a current high school senior to attend CMU?

	#	%
Definitely Would	12	60.0
Probably Would	5	25.0
Maybe	2	10.0
Probably Would Not	1	5.0
Definitely Would Not	0	0.0

In what year did you graduate from the major/certificate you chose above?

	#	%
2018	6	30.0
2017	2	10.0
2016	6	30.0
2015	1	5.0
2014	5	25.0
2013	0	0.0

How would you rate the overall quality of your education within that degree/certificate program?

	#	%
Very High	7	35.0
High	11	55.0
Average	2	10.0
Low	0	0.0
Very Low	0	0.0

What degree did you receive?

	#	%
B.S. Geosciences, Geology	19	95.0
B.S. Geosciences, Environmental	1	5.0
B.S. Geosciences, Secondary Education	0	0.0
A.S. Liberal Arts, Geology	0	0.0

Based on interactions while an undergraduate, CMU Geosciences faculty cared about my education.

	#	%
1-Strongly Disagree	0	0.0
2	0	0.0
3	3	15.0
4	7	35.0
5-Strongly Agree	10	50.0

Based on interactions while an undergraduate, CMU Geosciences faculty cared about my overall well-being.

	#	%
1-Strongly Disagree	0	0.0
2	0	0.0
3	5	25.0
4	6	30.0
5-Strongly Agree	9	45.0

Did you participate in student-faculty research?

	#	%
Yes	12	70.6
No	5	29.4
Total	17	100.0

If you participated in student-faculty research, please describe whether or not it was beneficial and how it was or was not beneficial.

- Very beneficial and student-oriented
- The research I participated was greatly beneficial. It allowed me to process and gather data, interpret results, and collaborate with other students/faculty not only from CMU but from other universities as well. I learned that asking questions and being engaged produces better results. My own projects allowed me to network with others who were also conducting research of their own. Those connections were invaluable because I developed some lifelong friendships and I would've never stumbled upon student-faculty research is beneficial through the application of classroom learned skills, and the experience gained from completing tasks associated with future employment.
- It was incredibly beneficial. Doing research hands on was the most beneficial concept. I got a job doing what my research was and that was because I had the experience.
- It was beneficial, I even Presented my research at the GSA in Indianapolis.
- It was beneficial as it gave me lab experience and field experience.
- I was expect to present information that was above my education level. I felt embarrassed when I was expected to present faculty research without having taken the classes necessary to understand the research.
- Good prep for grad work
- Both of my student-faculty research projects were very beneficial, as they prepared me for some of the types of field work and analytical thinking I have since had to use regularly on the job.

In what field of geosciences is your principal employment?

	#	%
Higher Education	0	0.0
Elementary or Secondary	0	0.0
Environmental Geology	6	30.0
Petroleum Geology	4	20.0
Mining (including sand and	3	15.0
Principal employment is	2	10.0
Other	5	25.0
Total	20	100.0

Other Responses:

- Business
- Construction/Roadway Geology
- Environmental Regulation and Compliance/GIS
- Environmental/Gov Contact

What aspect of the CMU Geosciences Program helped you the most in your employment or your life?

- Working with Bill Hood doing research and using XRD/XRF
- While little has changed in my life since graduating, I can say that any knowledge gained through structured research and study of new concepts is always an improvement in life.
- The opportunities to conduct research, present, and TA/internship
- The high number of field trips and in field discussions
- The GIS / GPS training; general sampling procedures; general field work
- The field camp and extra field trips outside the classroom gives great field skills.
- The faculty and amount of field work.
- Public speaking
- My knowledge of geology helps me when I am testing various properties of rocks. While I could test aggregate without this knowledge, it gives me a better understanding of what I am doing, overall.
- Minoring in GIS and basic understanding of how energy resources work.
- Honestly just having a geology degree helped me get my job. Knowing how lab tests work.
- Field work and GIS skills
- Field based support for the lectures. Learning the material then going outside and identifying examples.
- Construction

- CMU's accessibility to exposed field geology is immaculate, and I felt like it was used to its full advantage. The field trips, Western Slope field conference, and field camp class allowed me gain better comprehension on what I was learning in class. The field based introduction to geology, field methods, and depositional systems are the best course examples. The talks at GJGS exposed me to a variety of different topics in and outside the Grand Valley. As I progressed through the program, I real

What else could the CMU Geosciences Program have done to help you with your goals for the future?

- They should have pushed us more to do an internship. Finding a job with absolutely no experience was extremely hard. They also should have pushed us to work on our resumes a lot more and helped us make them look a bit more professional to have a fighting chance with candidates that have experience.
- The Geology Department could use more equipment, to improve our knowledge of Laboratory work.
- Push more internship announcements and job opportunities.
- Prepare more for jobs in local economy
- My goals were not centered on employment more oriented towards furthering my own education, along a path of interest. I am not sure that CMU could have done much better.
- My advice to the CMU Geosciences Program would be to stay more up-to-date with technology. For example, have students create a scientific poster in Adobe Illustrator. Use ArcGIS instead of TOPO! Keep teaching programs in the industry like Petra.
- More support for the taking the GRE as well as requiring students to take the FG, GIT fundamentals exam.
- More real life experience. AAPG trips can only get so in depth.
- Make you think and work out problems that arise. How to research and thing like a scientist. Learning to utilize field based data into a proper conclusion.
- Maintaining internship relationships with entities outside academia.
- Increased the amount of networking opportunities
- I wish I learned early on what industries employed geologists work in, what the different schedules and work locations would look like, what classes would benefit what industries, etc. I also wish I had time to take more classes, I understand the university has certain diversity of education requirements, but if I could have taken hydrology, more GIS, Soils classes, instead of Social Sciences, Biology, Humanities, it would have improved my skill as a geologist.
- Connecting students with employers
- Biology students have a list of relevant types of jobs they are qualified for when they graduate. I always wished the geology students had one of those.
- Better job placement programs.
- Better job placement contacts

Comments about your work experience that will help improve the CMU Geosciences Program:

- Required AutoCAD, rockworks, GIS labs for all geology majors.
- My work primarily involves the identification of various lithologies and trace elements. A mass spec would improve the students understanding of trace element analysis.
- More emphasis on understanding geophysics. The material I was taught was "dumbed" down
- I would offer a course like ore deposits or reintroduce basin analysis. These topics are essential to a student looking to get into the exploration field in the oil and gas or mining industry. An even more hands on approach
- I didn't get a job in geology till almost 2 years after graduation and even then its not even completely geology related.
- Experience! The one thing that is difficult to impossible to teach in a classroom. CMU could help by further developing base skills that all employees need. Computer/Social/Communication even adding budget, finance and cost analysis would be helpful.
- Engage students in both academic and private sector applications of geology, some staff focused heavily on academic research which was not helpful for students not planning on graduate school.
- Doing more field based exercises. For example Dep systems was soooooo beneficial because being hands on and understanding and then writing a scientific paper really was beneficial in my job now.
- Career planning/support is always helpful.
- Asking questions and staying inquisitive will help in university and throughout your career. Also making friends and being friendly in the workplace is a valuable skill.

Based on what you know now, how well do you think your undergraduate experience prepared you to:

	Very Well		More than Adequately		Adequately		Less Than Adequately		Very Poorly	
	#	%	#	%	#	%	#	%	#	%
Articulate the fundamental knowledge base and ideas of the major fields of geoscience	7	35.0	7	35.0	6	30.0	0	0.0	0	0.0
Collect and interpret geoscience field data	10	50.0	6	30.0	4	20.0	0	0.0	0	0.0
Collect and interpret geoscience laboratory data (Problem-Solving Skills)	8	40.0	5	25.0	7	35.0	0	0.0	0	0.0
Use technology (e.g. computer software) for evaluating quantitative geoscience data (Technology Skills)	3	15.0	8	40.0	9	45.0	0	0.0	0	0.0
Write an effective report on a geoscience study (Communication Skills)	5	25.0	11	55.0	4	20.0	0	0.0	0	0.0
Give an effective oral presentation on a geoscience study (Communication Skills)	6	30.0	13	65.0	1	5.0	0	0.0	0	0.0

Baccalaureate Student Learning Outcomes

Based on what you know now, how well do you think your undergraduate experience prepared you to:

	Very Well		More than Adequately		Adequately		Less Than Adequately		Very Poorly	
	#	%	#	%	#	%	#	%	#	%
Construct a summative project, paper or practiced-based performance that draws on current research, scholarship and/or techniques, and specialized knowledge in the discipline (Applied Learning/ Specialized Knowledge)	5	25.0	9	45.0	6	30.0	0	0.0	0	0.0
Analyze data critically, reason logically, and apply quantitative analysis methods correctly to develop appropriate conclusions (Intellectual Skills: Quantitative Fluency)	5	25.0	10	50.0	5	25.0	0	0.0	0	0.0
Make and defend assertions about a specialized topic in an extended well- organized document and an oral presentation that is appropriate to the discipline (Intellectual Skills: Communication Fluency)	6	30.0	9	45.0	4	20.0	1	5.0	0	0.0
Identify assumptions, evaluate hypotheses or alternative views, articulate implications and formulate conclusions (Intellectual Skills: Critical Thinking)	6	30.0	10	50.0	4	20.0	0	0.0	0	0.0

Job and Career Questions:

Are you working for pay right now?

	#	%
Yes, full-time	18	90.0
Yes, part-time	0	0.0
No	2	10.0

Only respondents who answered "Yes" they are working for pay right now answered the following questions.

In what type of organization is your principal employment? Mark the one best answer.

Self-employed in own business or professional non-group practice	2
Private for-profit corporation/company/group/group-practice	10
Higher education (public or private)	0
Elementary or secondary education (public or private)	0
International organization in the US	0
International organization outside of the US	0
US Military	0
Federal Government (except military)	3
State and local government, institution, or agency (except education)	1
Private non-profit organization (except education and international	0
Other	2

Other responses: Construction, Landscape

Which of the following best describes your current position?

	#	%
Entry Level	9	50.0
Mid-Level	7	38.9
Senior Level	0	0.0
Executive Level (except for chief executive)	1	5.6
Chief Executive (CEO, COO, CFO, GM or	1	5.6

How many years have you been in your current job type?

	#	%
Less than 3 years	15	83.3
3-5 years	2	11.1
6-9 years	0	0.0
10 or more years	1	5.6

Job and Career Questions (continued):

Is your current position related to your CMU field(s) of study?

	#	%
Yes, related to major(s)	15	83.3
No, not related	3	16.7

How well did CMU prepare you for your current career?

	#	%
Very Well	2	11.1
More than Adequately	5	27.8
Adequately	9	50.0
Less Than Adequately	0	0.0
Very Poorly	0	0.0
NA	2	11.1

What is your approximate annual gross income (before taxes)?

	#	%
Under $20,000	0	0.0
$20,000 - $29,999	0	0.0
$30,000 - $39,999	2	13.3
$40,000 - $49,999	2	13.3
$50,000 - $59,999	4	26.7
$60,000 - $74,999	4	26.7
$75,000 - $99,999	2	13.3
$100,000 - $149,999	1	6.7
$150,000 - $249,999	0	0.0
$250,000 - $499,999	0	0.0
Over $500,000	0	0.0

Job and Career Questions (continued):

Comments about your work experience that will help improve CMU:

- What else you can do with a geology degree, besides geology research, mapping, etc.
- Treat assignments and projects like they are your job. Don't just get in a habit of half halfheartedly doing projects to turn something in and get a grade. Actually think about them, actually put yourself into them, and then be willing to take the criticism from your professors. This is your opportunity to find your strengths and weaknesses and get help with them, in my opinion this is why you are in college, these are some of the most beneficial and applicable things that you can take away from your time here. Better to take the criticism now from your professors, than take it later from your employer.
- Push students to do internships stress the importance of it and have a resume workshop. Maybe also push them to do the full year or physics, chem, and calculus. As a back up if they can't find a job then they could easily go to grad school and not have to worry about taking 3 extra classes before they can get in.
- Need a job placement program!
- Keep the strong Geoscience professors. They are class acts!
- Instead of being told what to do explain why it would be useful to think and do on your own. For example, if you need a data base to organize data, learn on your own and make one. It's not just geology you will be doing it is always learning, growing and learning how to solve problems on your own.
- Get GIS experience. Everything now is kept in maps or is stored in databases and having a background in GIS can be beneficial.
- Already expressed in an earlier question.

Only respondents who answered "No" they are not working for pay right now answered the following question:

Why are you not currently working for pay? (Please mark all that apply)

	# of times checked
I chose not to enter the workforce at this time.	0
It has been difficult to find a position in my field.	1
It has been difficult to find a position paying an appropriate	1
I am raising a family.	2
I am currently a student.	1
I am doing volunteer work.	0
I am retired.	0
Other	0

If you have comments about previous employment, work experience, or job hunting that will help improve CMU,

- Need a masters in this field unless you become a mudlogger

Education since College:

Have you enrolled in a graduate, professional, or other degree/certificate program since graduating from CMU?

	#	%
Yes	4	20.0
No	13	65.0
No, but I plan to enroll in	3	15.0

Only respondents who answered "Yes" I have enrolled in another degree/certificate program since graduating from CMU
answered the following questions.

Are you enrolled in this program now?

	#	%
Yes, I am a full-time student	1	25.0
Yes, I am a part-time student	1	25.0
No	2	50.0

How long after you graduated from the degree/certificate program this survey pertains to did you start this program?

	#	%
Immediately (following fall or	1	25.0
1 Year later	2	50.0
2-3 years later	1	25.0
4-6 years later	0	0.0
NA	0	0.0

Altogether, how many years have/did you attend(ed) further schooling? Mark the best answer.

	#	%
None	1	33.3
1 - 2 years	0	0.0
3 - 4 years	1	33.3
5 - 6 years	0	0.0
NA	1	33.3

Education since College (continued):

How well did CMU prepare you for this educational program?

	#	%
Very Well	0	0.0
More than Adequately	2	50.0
Adequately	2	50.0
Less Than Adequately	0	0.0
Very Poorly	0	0.0
NA	0	0.0

What level of education are/were you pursing?

	#	%
Certificate	0	0.0
Associate	1	25.0
Baccalaureate	0	0.0
Post-Bacc Certificate	0	0.0
Master's	3	75.0
J.D.	0	0.0
Doctoral	0	0.0
Other	0	0.0

In which field and program are/were you studying and what is the name of the College/University you attended(ed)?

- Hydrogeology Clemson University
- M.S. geology University of Texas Permian Basin
- Geosciences Emporia State University
- MBA program

Did you complete this program?

	#	%
Yes	2	50.0
No	0	0.0
In the process of finishing	2	50.0

Other comments about furthering your education:

- Require 1 semester of differential equations for the geology degree.

Suggestions for improving the degree/certificate program:

- Stated earlier, but Students need to know what field of geoscience they think they would fit well into based on many factors such as pay, location, culture, work/life balance, economic opportunity etc.. and select classes, research, and internships appropriate to the perceived desires...
- Opportunities to develop skills in technology, writing, program management, and economics/business are always
- helpful -- for any career field!
- More Lab equipment so we can keep up with data analysis
- More field based classes like dep systems. We live in the heart of geology. Also, learn more about different basins that are beneficial in oil and gas.
- It would be very important to talk to students about the ASBOG for the PG. While Colorado doesnt have a license program for geology, students may find work in other states after graduation that do require this certification. In the 4 years at CMU, I heard zero mention of it until I found out about it online when looking at job prospects in my third year at CMU.
- Career counseling needs to be better. Students are almost left to their own to understand the degree process and what degrees paths are available based on their current credits and accomplishments. Small details like what degrees could be completed concurrently or with a little extra work what other degrees could be pursued. I found out in my senior year that I could have double majored if I had only taken two additional credits, unfortunately one of those classes was not offered during my senior year, however I could have taken it the prior semester, fulfilling both the needed credit and an elective.
- A master's program would be great to see. The field opportunities of the west slope is rare.

Additional Comments:

- Great Program, I learned an incredible amount and can bullshit geologists old and young in common terminology and logical geoscience thought processes. give yourselves a pat on the back and keep going into the field and get those kids to write reports on all those trips. Writing reports is a big part of most of the Post BS jobs I've had.
- The teachers are so incredibly great! The field trips are AWESOME
- None.

Demographic Questions:

What is your gender?

	#	%
Male	12	60.0
Female	7	35.0
Prefer not to respond	1	5.0

What is your ethnicity?

	#	%
American Indian or Alaskan	0	0.0
Asian	0	0.0
Black or African American	0	0.0
Hispanic of any race	0	0.0
Native Hawaiian or Pacific	0	0.0
White	18	90.0
Two or more races	0	0.0
Race and ethnicity unknown	0	0.0
Non-Resident Alien (of any	0	0.0
Prefer not to respond	2	10.0
Other	0	0.0

What is your current age?

	#	%
Under 21	0	0.0
21-24	4	20.0
25-34	10	50.0
35-44	3	15.0
45-54	1	5.0
55 or older	0	0.0
Prefer not to respond	2	10.0

Do you live in the state of Colorado?

	#	%
Yes	18	90.0
No	2	10.0

Demographic Questions (continued):

If yes, do you live in Western Colorado?

	#	%
Yes	16	80.0
No	4	20.0

CMU Alumni Survey Results - Combined 2013-2019
n=778

Year of survey

	#	%
2013	38	4.9
2014	68	8.7
2015	127	16.3
2016	187	24.0
2017	73	9.4
2018	158	20.3
2019	127	16.3

Overall, how satisfied are you with your undergraduate education?

	#	%
Very Satisfied	349	45.2
Generally Satisfied	358	46.4
Ambivalent	40	5.2
Generally Dissatisfied	19	2.5
Very Dissatisfied	6	0.8

While an undergraduate, about how often did you have conversations with faculty outside of class?

	#	%
Never	24	3.1
Rarely (1-2 times per semester)	97	12.5
Occasionally (3-5 times per semester)	184	23.7
Often (once every two weeks)	178	23.0
Very Often (at least once a week)	292	37.7

Demographic Questions (continued):

Would you encourage a current high school senior to attend CMU?

	#	%
Definitely Would	469	60.5
Probably Would	210	27.1
Maybe	73	9.4
Probably Would Not	12	1.5
Definitely Would Not	11	1.4

How would you rate the overall quality of your education within that degree/certificate program?

	#	%
Very High	284	36.5
High	341	43.8
Average	130	16.7
Low	18	2.3
Very Low	5	0.6

Job and Career Questions:

Are you working for pay right now?

	#	%
Yes, work full-time	611	78.5
Yes, work part-time	85	10.9
No	82	10.5

Only respondents who answered "Yes," they are working for pay right now, answered the following questions.

Job and Career Questions (continued):

In what type of organization is your principal employment? Mark the one best answer.

Self-employed in own business or professional non-group practice	35
Private for profit corporation/company/group/group-practice	242
Higher education (public or private)	50
Elementary or secondary education (public or private)	86
International organization in the US	15
International organization outside of the US	6
US Military	7
Federal Government (except military)	25
State and local government, institution, or agency (except education)	87
Private non-profit organization (except education and international organizations)	86
Other - 501c6 & 501c3 organization, Archery company, Banking, Corporate Mortgage Company, Internet Marketing, Oil & Gas Industry, Restaurant, Work for higher education, physical labor, Research Assistant, special district, Trucking…	41

Which of the following best describes your current position?

	#	%
Entry Level	250	36.3
Mid-Level	331	48.0
Senior Level	79	11.5
Executive Level (except for chief executive)	12	1.7
Chief Executive (CEO, COO, CFO, GM or principal in a business of other organization)	13	1.9
Graduate Assistantship	4	0.6

How many years have you been in your current job type?

	#	%
Less than 3 years	452	65.1
3-5 years	172	24.8
6-9 years	40	5.8
10 or more years	30	4.3

Job and Career Questions (continued):

Is your current position related to your undergraduate field(s) of study?

	#	%
Yes, related to major(s)	520	75.1
No, not related	172	24.9

How well did CMU prepare you for your current career?

	#	%
Very Well	177	25.7
More than Adequately	198	28.7
Adequately	240	34.8
Less Than Adequately	27	3.9
Very Poorly	15	2.2
NA	32	4.6

What is your approximate annual gross income (before taxes)?

	#	%
Under $20,000	46	7.5
$20,000 - $29,999	83	13.5
$30,000 - $39,999	143	23.2
$40,000 - $49,999	111	18.0
$50,000 - $59,999	94	15.3
$60,000 - $74,999	67	10.9
$75,000 - $99,999	47	7.6
$100,000 - $149,999	19	3.1
$150,000 - $249,999	3	0.5
$250,000 - $499,999	2	0.3
Over $500,000	1	0.2

Job and Career Questions (continued):

Only respondents who answered "No," they are not working for pay right now, answered the following question.

Why are you not currently working for pay? (Please mark all that apply)

	# of times checked
I chose not to enter the workforce at this time.	9
It has been difficult to find a position in my field.	24
It has been difficult to find a position paying an appropriate	15
I am raising a family.	16
I am currently a student.	44
I am doing volunteer work.	6
I am retired.	4
Other	32

Education since College:

Have you enrolled in a graduate, professional, or other degree/certificate program since graduating from CMU?

	#	%
Yes	241	31.0
No	367	47.2
No, but I plan to enroll in the next two years.	170	21.9

Only respondents who answered "Yes" I have enrolled in another degree/certificate program since graduating from CMU answered the following questions.

Are you enrolled in this program now?

	#	%
Yes, I am a full-time student	102	42.5
Yes, I am a part-time student	32	13.3
No	106	44.2

Education since College (continued):

How long after you graduated from the degree/certificate program this survey pertains to did you start this program?

	#	%
Immediately (following fall or spring)	111	46.1
1 Year later	51	21.2
2-3 years later	59	24.5
4-6 years later	15	6.2
NA	5	2.1

Altogether, how many years have/did you attend(ed) further schooling? Mark the best answer.

	#	%
None	15	6.3
1 to 2 years	141	59.2
3 to 4 years	59	24.8
5 to 6 years	15	6.3
NA	8	3.4

How well did CMU prepare you for this educational program?

	#	%
Very Well	87	36.3
More than Adequately	67	27.9
Adequately	64	26.7
Less Than Adequately	9	3.8
Very Poorly	4	1.7
NA	9	3.8

Education since College (continued):

What level of education are/were you pursuing?

	#	%
Certificate	19	8.0
Associate	12	5.1
Baccalaureate	25	10.5
Post-Bacc Certificate	5	2.1
Master's	118	49.8
J.D.	19	8.0
Doctoral	39	16.5
Other	0	0.0

Did you complete this program?

	#	%
Yes	85	35.7
No	19	8.0
In the process of finishing	134	56.3

Demographic Questions:

What is your gender?

	#	%
Male	307	39.9
Female	446	57.9
Prefer not to respond	17	2.2

What is your ethnicity?

	#	%
American Indian or Alaskan Native	11	1.4
Asian	13	1.7
Black or African American	6	0.8
Hispanic of any race	50	6.5
Native Hawaiian or Pacific Islander	4	0.5
White	618	80.5
Two or more races	28	3.6
Race and ethnicity unknown	1	0.1
Prefer not to respond	30	3.9
Other	6	0.8

Demographic Questions (continued):

What is your current age?

	#	%
Under 21	7	0.9
21-24	191	24.7
25-34	413	53.4
35-44	91	11.8
45-54	39	5.0
55 or older	18	2.3
Prefer not to respond	14	1.8

Do you live in the state of Colorado?

	#	%
Yes	574	74.3%
No	199	25.7%

If yes, do you live in Western Colorado?

	#	%
Yes	416	57.7%
No	305	42.3%

Colorado Mesa University Geosciences Program

External Review

February, 2022

Anne E. Egger

The report offers my assessment of the strengths and weaknesses of the program, along with recommendations, based on a thorough reading of the self-study and a one-day visit to campus on February 25, 2022. On that visit, I met with faculty, current students, and alumni; attended meetings of two different classes; received a tour of the facilities and campus; and met with administrators from across the university.

Best practices employed by the program

The geosciences program is student-centered and invested in student success. Faculty care about students, both their learning and their lives, and the students recognize that. Faculty mentor students in authentic research experiences, design and offer courses that are meaningful and relevant, work one-on- one with students outside of class, are mindful of the costs of textbooks and course fees, help students obtain funding, and connect them with opportunities for networking. Students feel supported and alumni value their experiences in the program. The ethic of attending to students' success is deeply embedded in the program.

The program takes full advantage of its surrounding natural geologic classroom to build students' skills. A wealth of Earth materials and processes are exposed and accessible within a short drive of campus, and bringing students out into the field regularly to explore these real-world settings and collect data is a significant strength of the program. Field experiences are frequent and scaffolded to build students' skills to a culminating experience in which students take on more of the planning and decision- making that guides data collection, analysis, and interpretation.

Research experiences are embedded in the program. All students in the geosciences program engage in a mentored research project as seniors, beginning with a research proposal and continuing through to presenting their work on campus at a minimum and potentially at a regional or national meeting of the Geological Society of America. Faculty are active in research, collaborate with colleagues at other institutions, and involve students in their work. Research is a high-impact practice shown to be effective for learning. Authentic research experiences also make CMU students more competitive in both graduate school applications and to employers.

GIS skills are embedded in the program. The GIS program is a significant strength of the geosciences at CMU, helping students develop a skill that they will almost certainly use in their careers (all of the alumni who participated in the call said they use it). Students see and appreciate the career connections.

Evidence of student learning and quality found in students' work

Students in the geosciences program at CMU are producing high quality work, as evidenced by presentations at national meetings such as the Geological Society of America Annual Meeting and the regional Grand Junction Geological Society meeting. The research requirement that is part of the senior seminar in the curriculum undoubtedly lead to these successes. As a result, students receive internal and external awards for their work and gain entrance to competitive graduate schools, and local companies hire multiple graduates from the program.

Weaknesses/challenges identified in the program

The program functions well, but lacks a bigger vision and sense of value and goals. Both the university and the program have been in a period of rapid change for several years. It is not clear that there is a coherent vision in the current faculty for what the program can and should be doing, or that they have common goals that can guide decision-making. Faculty are dedicated to the program and to students, and the pieces of the program function well, but those pieces do not feel like they come together into a greater whole. This sense manifests itself in the current student learning outcomes, which are functional and assessable, but also rather specific and somewhat reductionist, outlining a set of skills without giving those skills purpose or meaning.

Key components of the program rely heavily on volunteer efforts and faculty near retirement. One heavily-used laboratory facility is run and maintained entirely by a retired geologist contributing as a volunteer. The courses in the critically important and popular GIS program are taught by a single faculty member who teaches a substantial load each term. These are single points of weakness, as the loss of either of these individuals through retirement will have a significant impact on two of the most successful components of the program.

Attracting students to the program through active outreach has not been a focus. The program has been successful in attracting students to the program through their introductory courses, and have relied on these as the primary opportunity for recruitment. The number of majors has fluctuated significantly over the past ten years, and the reduction in introductory sections due to COVID-related issues has undoubtedly had an impact. However, more active recruitment might help increase and stabilize the number of majors.

The size of the program limits the number of electives that can be offered and limits opportunities for faculty to innovate in research and teaching. Students and alumni expressed regret that many electives were not available to them because they were infrequently offered. Faculty would like to be able to teach more electives (and engage in more research), but have to make sure that each elective will have enough students enrolled and already carry a substantial teaching load with introductory courses and required courses. Without growth in the number of majors and in the number of faculty, it will be difficult to expand offerings in the program.

The lack of a lab coordinator creates inefficiencies in introductory courses. The high enrollment in courses and labs at the 100-level means results in several sections being offered. In most programs where this is the case, a lab coordinator keeps these multiple sections organized

(and often supports teaching assistants). Although student workers have helped, the lack of continuity and irregular support means that much of the work falls back on the faculty, creating inefficiencies and again limiting opportunities for innovation.

Strategies the program faculty members might take to address these elements

Major recommendations

Develop a vision and goals for the program that can guide strategic planning. There have been a lot of transitions in the faculty and instructors in the last several years, and of course the last two years of a pandemic have brought their own challenges. The institution also has a new president who is developing new initiatives. With several new faculty in the program, now is a good time to develop or refine the mission of the program, and develop or refine goals that can bring everyone together and allow faculty in the program to be strategic in where they invest their limited time and efforts. As other retirements near, a clear set of goals will allow the faculty to make a compelling case for new hires that can help make progress towards those goals.

Revise program-level student learning outcomes to be more holistic and inspirational. Moving to fewer, more holistic learning outcomes that give purpose and direction to the skills and inspire students (and faculty) to develop the qualities of a geoscientist. For example, I imagine that none of the faculty feel it is sufficient for a student who is graduating with a geoscience degree to simply demonstrate that they know things—they want students to be able to *use* that knowledge to address a problem, or put new data in context, or to develop a research question. A potential new learning outcome would be something like, "Apply an understanding of Earth processes to address a relevant research question." In your current program, the senior seminar could be a place to assess this by looking at the background information for their research project. Assessment could then move beyond looking at the accuracy of geologic maps (which is a very specific skill) to ability to synthesize and evaluate data to answer questions.

Build on the strengths of the relatively "closed" regional system to attract students to the geosciences program and support them through graduation and employment in the field. Faculty have already responded to student interest in learning more about careers earlier in the program by inviting alumni who work in industry to speak in their classes and providing more opportunities for networking. The program currently has many connections that could be further developed to attract high school students and current CMU students to the program. Concurrent enrollment classes at regional high schools could be further developed and used more effectively as recruiting opportunities; the embedded community college provides an additional pathway. Exposing high school and early college students to careers in the geosciences that allow them to stay in the region can inspire students to pursue studies. An additional recommendation is to reinvigorate the discussion of developing a Master's program in geology, which would fill a void in the region and thus be directly aligned with the university's mission. Such a program would likely be appealing to regional employers as well, and could increase enrollment in upper- level courses to allow for more frequent course offerings. The president's new Advance CMU initiative may be an avenue to explore funding opportunities to launch such a program. In addition, the current efforts of the faculty to establish an advisory board, presumably including

local employers of geoscientists, will help the program make progress towards this recommendation.

Additional recommendations

Explore options for establish an equipment maintenance and replacement fund. The program has been very successful in obtaining laboratory equipment to support research and teaching with research- grade tools. The recent acquisition of a magnetometer and refraction seismic equipment will enhance these capabilities in the field as well. However, several concerns were expressed about replacing this equipment when it breaks, particularly when support for writing large grants is limited. One possibility would be to establish a cross-departmental fund could be allowed to build up and used as needed by different programs.

Explore options for establishing a staff-level lab coordinator position. An investment in this staff position could allow for much more flexibility on the part of faculty in teaching and open other options for student workers in recruiting and otherwise supporting the program. There is potential for this position to be shared with other programs as well, and/or to support student research in the lab.

Open discussions with other programs and departments to find opportunities for cross-pollination

in courses, particularly in ways that could expand the electives in the major. Are there upper-level courses in geology that students in other programs could take? If geological engineering were open to both engineering students and geology students, would enrollment be high enough to offer it more frequently? Could a geophysics course be taught for both physics and geology students? At the 100-level, are there geoscience courses that might be valuable for other programs, such as agriculture or civil engineering? As the Watershed Science minor becomes more established, consider developing other interdisciplinary opportunities that bring students from other programs into the geosciences.

Reviewer summary

The geosciences program at Colorado Mesa University is providing an excellent education for students as a result of dedicated faculty who employ high-impact practices. The quality of the program is equal to or better than programs at other universities of a similar size, yet the teaching load is accommodated by fewer faculty and instructors, limiting their ability to innovate, attract students, and engage in scholarship. Despite these limitations, students who graduate from the program are successful in obtaining jobs in the geosciences and pursuing graduate studies. In the wake of a number of transitions in the faculty and the rapid growth of the university, the program would benefit from spending time to define programmatic goals and identifying strategies to meet those goals. They might consider applying for a Traveling Workshop offered by the National Association of Geoscience Teachers to bring in outside facilitators to lead this effort and help them develop an action plan. Within this small, cohesive program, such a process could be both enjoyable and invigorating, and help focus efforts that would grow the program.

Executive Summary Template for External Reviewer's Observations

Program Review Element	Check the appropriate selection				Provide explanation if not agree with element and/or why unable to evaluate
	Agree	Not Agree	Unable to Evaluate	Not Applicabl	
The program's self-study is a realistic and accurate appraisal of the program.	X				
The program's mission and its contributions are consistent with the institution's role and mission and its strategic goals.	X		X		A programmatic mission is not present in the self-study, but the contributions are consistent with the institution's mission
The program's goals are being met.			X		No programmatic goals were provided in the self-study.
The curriculum is appropriate to the breadth, depth, and level of the discipline.	X				
The curriculum is current, follows best practices, and/or adheres to the professional standards of the discipline.	X				
Student demand/enrollment is at an expected level in the context of the institution and program's role and mission.	X				
The program's teaching-learning environment fosters success of the program's students.	X				
Program faculty members are appropriately credentialed.	X				
Program faculty members actively contribute to scholarship, service and advising.	X				
Campus facilities meet the program's needs.	X				
Equipment meets the program's needs.	X				See recommendations
Instructional technology meets the program's needs.	X				
Current library resources meet the program's needs.	X				
Student learning outcomes are appropriate to the discipline, clearly stated, measurable, and assessed.	X				See recommendations
Program faculty members are involved in on-going assessment efforts.	X				
Program faculty members analyze student learning outcome data and program effectiveness to foster continuous improvement.	X				
The program's articulation of its strengths and challenges is accurate/ appropriate and integral to its future planning.	X				