2020

50 Years Celebrating Earth, Atmosphere, Astronomy, and Oceans: Stories of a Great Department

William Henry Hoyt

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Stories of a Great Department

By William H. Hoyt, Ph. D.

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Department of Earth Sciences (Earth & Atmospheric Sciences) 1970-2020

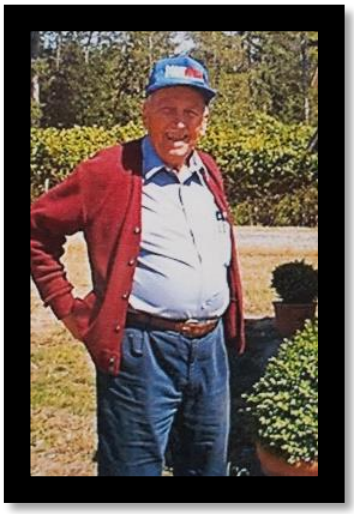
1956-1970s: THE FIRST YEARS, Tollefson the Magnificent

The first tale I ever heard about how the Department of Earth Sciences started hearkens out of the mid-1950s. Oscar W. Tollefson, who had almost graduated from the Univ. of Colorado (Ph D in geology), found himself sitting next to Colorado State College (CSC) President Bill Ross on a commercial flight between Washington, D.C. and Denver. Tolley, as he was universally known in professional circles, was the loquacious sort and so of course he struck up a conversation with a guy who, it turns out, was an amateur rock , fossil, and mineral collector. Bill Ross came from a background in buildings and grounds and knew a lot about earth materials and weather! Though we don't know exactly what was said in that four hours, we do know that Bill Ross recognized a rare enthusiasm for teaching and learning in the young Tolley. Ross also probably recognized that Tolley's persuasiveness and persistence would go a long way at the growing College. The Earth Sciences academic program was founded at Colorado State College (CSC) in 1956 by Dr. Tollefson.

Before that flight ended, Dr. Ross asked Tolley if he would consider a job teaching geology at CSC. Well, of course, Tolley didn't say, "No", and in September he found himself as a member of CSC's Science Division, sharing a small office in Cranford Hall (the original academic building on campus) with five other science faculty members and a part-time student secretary. Cranford Hall is gone now, but the building's cornerstone is still there, just north of the Garden Theater.

Tolley (photo to right) worked the required twelve months per year, for an annual salary which is less than an average UNC instructor makes in a month now. And he taught a fifteen-hour teaching load each quarter, including summers! To put that into perspective, that would have been approximately 18 separate preparations per year. By contrast, in 2020 typical faculty class preps per year (spanning 9 months) number about 4-10 for each full-time faculty member. Of course, we are on the semester system now, as opposed to the quarter system back then!

Certainly, geological and atmospheric attractions and phenomena of the area made Greeley a naturally attractive place to start an academic department in the earth sciences. Generally clear skies meant that an observational astronomy program would be active on the campus; finally, the presence of the fuel-rich Cretaceous Western Interior Seaway in Colorado (and the easy access to oceans) meant that oceanography teaching and learning could thrive in Greeley as well.



For nine years Tolley was the only earth scientist at Colorado State College. He taught a variety of courses, including general geology, physical geology, historical geology, geomorphology, mineralogy, economic geology, Rocky Mountain geology, oceanography, science readings, and lots of sections of SCI 5, the general education earth science course required of every CSC undergraduate student. During this period Tolley started a minor program in earth sciences, which included courses in geology and oceanography as well as meteorology (taught by Science Education Professor Leslie Trowbridge-photo at right) and astronomy (taught by Mathematics Professor Forrest Fisch).

In 1957, at the height of the Cold War, the USSR launched Sputnik, the world's first Earth-orbiting satellite. This apparent lag in U.S. technology encouraged our government to spend lots of money during the late 1950's and early 1960's to help colleges and universities nationwide produce more and better trained scientists. Thus, at CSC, in 1964 Ross Hall of Science was constructed, and in 1965 a second full-time geologist, Lee Shropshire, a half-time astronomer, Carl Lilliequist, and the first teaching assistant, Roger Bybee, were added to the Earth Sciences faculty. Les Trowbridge continued teaching meteorology four more years. The first undergraduate degree program in earth sciences, a Bachelor of Arts in Teaching, was initiated that same year. The program's first graduate, in 1967, was Jack Murphy, who went on to be Curator of Geology at the Denver Museum of Nature and Science (and UNC Ross Science Award winner/Honored Alumni in 2001). He also earned a Master of Arts degree in Earth Sciences in 1994.

Also, in the wake of the Tolley years there were two more honored alumni from the 1960s. Rodger Bybee (photo at right) earned a bachelor's degree in biology from UNC in 1966, a master's in science education at Colorado State College in 1969, and a doctorate in science education at New York University in 1969. Roger enjoyed teaching geology and meteorology as a teaching assistant and faculty member at the UNC Laboratory School, and later went on to become the executive director of the Biological Sciences Curriculum Study (BSCS). That organization led national efforts to champion learning strategies known as the 5 Es (engage, explore, explain, elaborate, evaluate), and he had pivotal roles in creating the National Academy of Sciences' National Science Standards. His leadership and reputation for ethical and scientific integrity ensured that the Earth Sciences and applied topics such as the human role of climate change were included in the National Science Standards. Roger was recognized at a UNC honored alumni ceremony in the spring of 2006. It is fair to say that Rodger was the most influential science educator of the 1990s and 2000s in the entire world.

BRIEF STORY-HISTORY OF UNC DEPARTMENT OF EARTH SCIENCES

In 1963, I transferred to Colorado State College from the University of Colorado – Boulder. My declared major was Biology with an emphasis on Ecology. Sometime in the academic year 1963-1964, my advisor informed me that because I was majoring in a science and planned to teach, I would have to take an Earth science course, and it could not be Science 5 (Earth Science for non-majors).

I enrolled in Physical Geology taught by O. W. Tollefson. The course met in Cranford Hall. From the beginning of the course, I was excited by the content. To say the least, I fell in love with geology and eventually the other Earth sciences. Because I had completed most of my Biology major, I could continue taking other courses—historical geology, geomorphology, astronomy, meteorology, etc. I took Earth science courses when possible through the academic year 1964-1965.

The college initialed student teaching as an intern program for the year 1965-1966. The program involved teaching one-half day in Greeley schools and continuing college courses for one-half day. I applied and was informed there were no opportunities to student teach in biology; would I consider teaching 9th grade Earth Science. I said yes, while maintaining my very real enthusiasm for the chance to teach the disciplines of Earth science.

My student teaching was at Heath Junior High in Greeley. My supervising teacher was Donald Adams. Don and I got along very well. He was a great mentor for my introduction to teaching 9th grade. During my year at Heath, we were field testing a new program titled "Investigating the Earth" that was developed by the Earth Science Curriculum Project (ESCP).

During the year 1965-1966, I continued taking Earth science courses and graduated with a B.A. in the spring of 1966. By that time, I had 19 credits, approximately the equivalent of a minor in Earth Sciences, and had taught Earth science for a year. There was an opening to teach 9th grade Earth Science at the Laboratory School. I applied and was hired to teach two classes for the academic year 1966-1967. I was able to introduce the new ESCP program at the Laboratory School. In addition, I assisted O.W.

Tollefson with the laboratory of his Historical Geology course. And, late in the year, much to my surprise, I was invited to teach a section of the course, Science 5—Earth Science for non-majors. I also began working on a Master's degree in Science Education and continued taking courses in the Earth sciences, e.g., Physical Meteorology, Climatology, Oceanography.

The Earth Science Department received a National Science Foundation grant to provide in-service training for the new ESCP program. The program was for teachers in the greater Denver area for the academic year 1967-1968. The program included content in the Earth science discipline taught by UNC faculty, e.g., Leslie Trowbridge taught meteorology, and I introduced the laboratory investigations of ESCP for the pedagogical component of the program.

During the academic year 1968-1969, we expanded the in-service program to include teachers in rural districts, especially in northwest Colorado. James McClurg had joined the Science Education Department. His work in geology, especially plate-tectonics, served as a complement to my teaching the laboratories and pedagogy. I continued teaching Earth Science at the Laboratory School.

In 1969, I finished my Master's degree and continued teaching in the Earth Science Department and the Laboratory School. My title was Instructor of Earth Science at Colorado State College and in 1970 the University of Northern Colorado. By the time I left UNC for a PhD program at New York University, I had accrued 55 credits, roughly a major.

My story sketches the early years of Earth sciences at Colorado State College and in May 1970 to the University of Northern Colorado. Faculty such as O.W. Tollefson, Lee Shropshire, Leslie Trowbridge, Forest Fish (Math Department—taught astronomy; later Carl Liliequist taught astronomy), Dick Dietz, and Ken Hopkins established the foundation for the future of the UNC Department of Earth Science.

My own interest in the Earth sciences has continued through support for the Earth sciences in the 1996 National Science Education Standards and the 2013 Next Generation Science Standards.

To say that I am pleased that circumstances brought me to an understanding of and appreciation for the Earth sciences is true. The Earth science faculty during the years 1963-1969 nurtured my love for the disciplines.

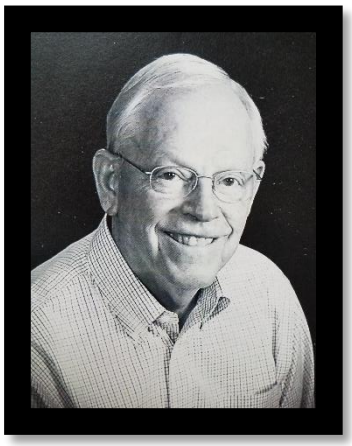
I think the combination of studying both ecology and the Earth sciences provided me with a unique foundation that continues to influence important aspects of my career. For example, I became a voice supporting the inclusion of Earth science in the 1996 National Science Education Standards. My view for the inclusion of Earth science was expressed in opposition to a minority claiming we did not need the Earth sciences because they really were only physics and chemistry. In the end, NSES includes the Earth sciences. Likewise, in the 2013 NGSS, some were reluctant to include climate change. As part of the leadership team, I supported the inclusion of disciplinary core ideas and performance expectations associated with humans' influence on climate.

The Earth science faculty and experiences teaching 9th grade and undergraduate courses, as well as in-service courses for elementary and middle school teachers, established a life-long interest in and support for the role of Earth systems in the education system.

Rodger W. Bybee, UNC BA, Biology and Master's, Science Education; Faculty Member; Ph. D. Science Education, New York University; Director of Biological Sciences Curriculum Study; Director of the National Science Education Standards of the National Academy of Sciences, and a Member of the Leadership Team of the Next Generation Science Standards (WHEW!!)

The second honored alumni from those early years was James Valdez, who earned his UNC degree in 1969. Mr. Valdez went on to a distinguished career in NASA's meteorology unit and was honored in a UNC ceremony in 2007. I ran across Jim by means of him reaching out to UNC. Like many of the honored alumni associated with our Department, Jim was remarkably grateful that we made sure UNC knew they deserved the award.

The Earth Science Department's connection with the graduate Department of Science Education was strong throughout the 1970s and the mid-1980s. Jay Hackett received his doctorate from that Department in 1972, then began teaching at the Science Education Department and with a part-time appointment in Earth Sciences. He joined the Science Education faculty fully in 1978 and later joined the Earth Science Department in 1983 after the Department of Science Education was eliminated in a UNC program exigency reduction in force (RIF). That RIF resulted in about 20% of UNCs faculty leaving the University (by eliminating programs). He taught many thousands of elementary licensure students earth sciences in a number of course formats as Colorado and UNC changed requirements for elementary licensure. Jay also went on sabbatical to Washington, D. C. in 1996-97 to work on the National Science Standards with Roger Bybee and others. The National Academy of Science "bought out" Jay's next year 1997-98, in a very rare move. Jay was given the UNC William R. Ross Award for Science/Honored Alumni in a ceremony in 2003—and I think he gave the best speech I have ever heard at one of those ceremonies! By the way, if you are looking for the best-dressed guys in the world, Jay Hackett and Rodger Bybee can show you what's what!



Dr. Good Luck

Let me begin by saying that I am the luckiest person to every occupy a teaching position in the Department of Earth Sciences at the University of Northern Colorado. As a UNC graduate student in the late 70's, I chose a support content area in the Earth Sciences taking courses in astronomy, geology, and meteorology. My professors included Dick Dietz, Lee Shropshire, Glenn Cobb, Ken Hopkins, Vince Matthews, and Jim McClurg. My major science education professor, Les Trowbridge, later announced: "Jay was like the proverbial camel who poked his nose under the tent for so long he wound up joining us inside." - My first stroke of good fortune! I won't bore you with the details, also laden with luck. My initial appointment in 1973 was split between Science Education and Earth Sciences. Then in 1982, the Science Education Department and its Professors were terminated, and I was appointed full time in the Earth Sciences. Lucky me! Rich Slater and then Bill Hoyt rounded out the Department during my tenure. By the way, the glue bonding the department in many significant ways was our, "one of a kind", Office Manager -Vicki Ouellette. Vicki was the perfect fit for this character-rich group of professors.

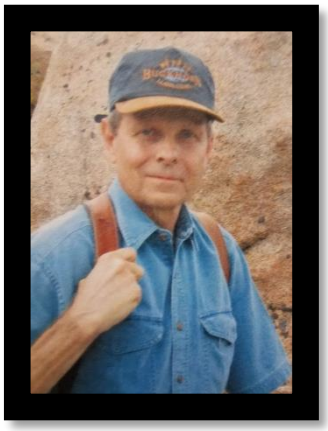
It didn't take very long for me to realize how different the Earth Sciences faculty was from those in other departments in Ross Hall. Both intra-and inter-departmental competition and in-fighting was common in other units. Participation in a number of university committees revealed a similar pattern of faculty behavior across the campus. While the individual faculty members within the Earth Sciences were very diverse in personality, interests, and teaching styles, it was obvious that they actually liked and respected each other. They were cooperative in spirit rather than competitive in nature. Here is just one example. The Earth Sciences faculty split their annual budget allotment evenly among themselves. I remember thinking that the total budget was pathetically small. One at a time each professor identified his most urgent needs and then the amicable bartering began. Individuals would offer a portion of their allotment to help someone else get what they needed. Every year Ken Hopkins brought forth his request for six stereoscopes - the cost of which excessively exceeded his share. Ken eventually got his wish. I can still remember the huge grin on his face, and smaller but sincere smiles from the rest of us.

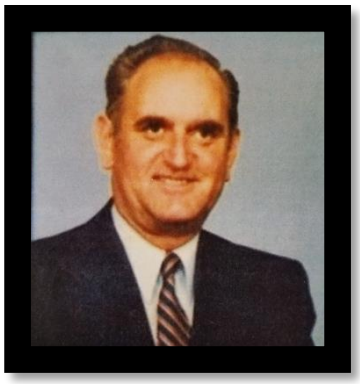
Field trips were highlights! In the field, the true nature of the each of the professors was revealed. Lee had so much to share that the last outcrop for the day was occasionally observed in the van headlights. Ken employed an effective inquiry approach by asking his students to propose explanations for how a particular landscape feature was formed, and cite evidence supporting their claim. I did not have the privilege of participating in field studies with Bill Nesse, or Bill Hoyt, however, "rumor" has it that they were both exceptional as well. My personal favorite was the Total Solar Eclipse of 1979 in Glasgow, Montana, led by Dick Dietz!

Allow me to close this tale by re-emphasizing my opening statement of personal good fortune. During my 12 years of teaching junior high school students, followed by 25 years at the University of Northern Colorado, I can honestly say I never had a bad day! That stretch of personal good fortune was made possible by my association with caring professional colleagues, defined by their commitment to students, and respect for their fellow colleagues rather than feeding personal egos! Now you see why I am the luckiest one of all!

Jay Hackett, Ed D, Emeritus Professor of Earth Sciences and Science Education

In 1969 Dr. Tollefson retired, but before he left he assured the continuing development of Earth Sciences by convincing Science and Math Division Chairman, Dr. Harley Glidden, to hire not only a geologist, Kenneth Hopkins (2000 Favorite Teacher Award, photo to left), to replace him, but also the program's first full-time astronomer, Richard Dietz, and its first full-time meteorologist, Glen Cobb (photo to right). Until 1970 Earth Sciences had been merely a program within CSC's Division of Science and Mathematics. But in that year Colorado State College became the University of Northern Colorado, and our program became the Department of Earth Sciences within the new College of Arts and Sciences. If President Ross gave life to the Department, Tolley and his compatriots gave the program breath and the personal touch. (Shropshire photo in the middle I think on his favorite outcrop of the Fountain Fm. at Sylvan Dale Ranch).





Even after he retired, Tolley was professionally active--and as talkative as ever. Here is a story about Tolley and James Michener that Vince Matthews relates. It gives you a flavor of why Tolley was a force to be reckoned with.

NO TACO TOLLY

The Rocky Mountain Section Meeting of GSA was at CU in Boulder in 1973. At a lunch break, I invited Tolly to join me. The cafeteria in the Student Union was sort of an early version of a food court. We got in one of the lines and began visiting. Tolly was quite the garrulous retiree.

I soon realized that the person standing in line in front of me was the author, James Michener who was attending the meeting for background on the novel he was currently writing--*Centennial*. He was by himself. So, I introduced myself and Tolly. He was quite cordial. And, Tolly began talking. And talking. And talking. And talking. Neither Michener nor I could get a word in edgewise. I thought to myself, "Here is the opportunity of a lifetime (I had read all of his books), and I have to listen to Tolly." This went on for a while as the line inched toward the opening of our part of the cafeteria.

Tolly suddenly realized that we were in a line for Mexican food. His Scandinavian genes hadn't prepared him for that. In alarm, he said, "My stomach won't take this. Let's go over to the American cafeteria." I replied, "Tolly you go ahead, I like Mexican food." And, as one might expect from the author of *Iberia,* Michener concurred. Off went Tolly, leaving me "stranded" one-on-one with one of the most noted authors of the day. My characterization of Michener was borne out by the student cashier. She read his name tag and really couldn't place him, but said, "You're somebody famous aren't you? May I have your autograph?" Which he graciously provided.

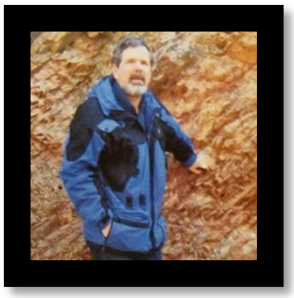
We picked a booth where I enjoyed one of the most memorable times of my life. Several times during the meal I thought how different the experience would have been if Tolly had joined us. (Bless you, Tolly, for being Scandinavian). At the time, I was unaware that Michener had gotten a Master's degree and taught at UNC before going to the South Pacific where he wrote of all things, *South Pacific*. A decade or so later, he gave the commencement address at CU and told the graduates to try lots of things before deciding what to do in life. He told them that had he not done so he might still be teaching at a small mid-western college (read Greeley).

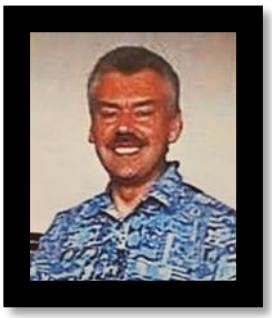
During that lunch I asked him what he was most proud of, expecting him to tell me a particular book. Instead, he said that serving on the commission that rewrote the Constitution of Pennsylvania was what he was most proud of.

Vince Matthews, Ph.D., E 4470 Pinewood Circle, Eleva WI 54738, 719-293-2222

Director, Colorado Geological Survey (Retired); Leadville Geology, Principal; Advisory Board, University of Wisconsin Eau Claire's Geology and Responsible Mining Initiative ; Board of Directors, National Mining Hall of Fame and Museum

Evolution of the Department and Its Programs





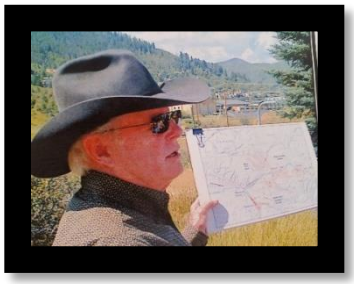
During the years since 1970 the Department of Earth Sciences has evolved, matured, and developed significantly in several dimensions. New faculty were added in geology – Vincent Matthews 1971-76, William Nesse 1976-2002, Jared Morrow (photo to left) 1998-2006, to replace Lee Shropshire (Favorite Faculty Award) who retired in 1998, Graham Baird 2003- to replace Bill Nesse, Emmett Evanoff 2006- to replace Jared Morrow, Steve Anderson 2015- a volcanologist (Winchester Award), environmental geologist, and hydrologist who came to us from being the Director of the Math and Science Teaching Institute, Sharon Bywater-Reyes 2017 (2019 SPARC New Faculty Achievement Award)-geomorphologist and environmental geologist to replace Ken Hopkins and Tim Grover 2018- to replace Bill Hoyt as chair; oceanography – Richard Slater 1972-79, William Hoyt 1981-2019, (Harrison Award); meteorology – Andre Erasmus (photo in center) 1992-1997, Bruce Lee 1997-2003, Cathy Finley 1998-2003, Andre to replace Glen Cobb who retired in 1992, Gary Huffines 2003-2011, Lucinda Shellito 2006- (Fulbright Scholar), Wendi Flynn 2011- to replace Gary Huffines, and David Lerach 2012-; earth science education – Jay Hackett 1978-98 (2003 Ross Science Award winner/Honored Alumni), Mike Taber 1998-2003 SPARC New Faculty Achievement Award), and Joe Elkins 2004- (Biggs Award); and general education earth science – Rita Leafgren (photo above to right) 1989-2012 (Burlington Northern Teaching Award) and Byron Straw, 1996- (Favorite Professor Award).

Rescued from a Rock

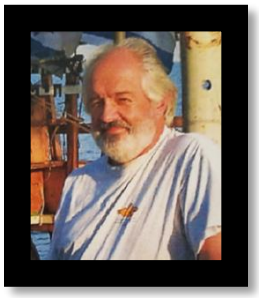
In the summer of 1969 O. W. Tollefson rescued Dick Dietz from exile on a rock (commonly known as Oahu) in the middle of the Pacific Ocean. The transition from Honolulu to Greeley was a bit of a culture shock, but in a good way. Dick also switched from a commodious office to a space originally designated to be a closet. A bigger change was going from a position where he was surrounded by astronomers to one where the nearest other astronomer was over thirty miles away. This turned out to be a mixed blessing because even if there was no one around to collaborate with, there was also no one to tell him how to run an astronomy program. It took him a couple of years to get the hang of teaching, but he immediately began a lifelong love affair with the night sky. The astronomy facility at UNC was always too modest to be called an observatory. For many years it was housed in the garage of a small building on the west side of campus. From there several small telescopes would be brought out every clear night to allow generations of students to admire the wonders of the planets, stars, and nebulae. Campus reorganization later forced an involuntary relocation of the astronomy lab to a Tuff Shed located next to the old Lab School. Over the course of five decades he probably supervised more than four thousand two-hour lab sessions, far too many of which were in temperatures below freezing. Over thirty years of delightful association with the Department of Earth Sciences came to an end in 2003 when he was traded to the Department of Physics for a meteorologist to be named later. {this eerily sounds like the NFL draft, but the analogy is right on}! In moving from the top floor of Ross Hall to the lowest floor he left behind many friends, but it worked out well for all parties. Some say he can still be seen wandering the halls of Ross waiting for night to fall.

Richard Dietz, Ph D, Professor of Astronomy, Department of Earth Sciences, then Department of Astronomy and Physics

And in a story a few decades later about Dr. Dietz, one time the Department invited a prominent Denver exploration geologist to deliver a Friday afternoon seminar about a crypto-explosive subsurface feature in Iowa that was being investigated as a possible oil and gas target : Susan Landon. Unbeknownst to any of us in the Department, Dick and Susan went out for a beer afterwards to swap mountain-climbing stories. To make a long story short, they got married and shocked the entire Department at a surprise party to announce the happy news. You CAN see it was in the stars!



Chairs during the early years included Drs. Tollefson prior to 1969, Dr. Shropshire, Dr. Matthews (photo to left), Dr. Slater (photo to right), and Dr. Cobb. They generally stuck to three-year terms, or less, during those early years. Resources to accomplish growth were hard to come by and produced considerable frustration among the chairs. That trend continues to this day, with notable exceptions. Many of those exceptions were fueled by external grant monies or deans who saw opportunities.



Much later we also added a part-time lab coordinator in 2005, who was ¼ time in Earth Sciences and ¼ time in Physics. In 2015 we hired a ½-time lab and internship coordinator-Steve Good, Ph D. And since 1979 Vicki has been our Department Secretary/Administrative Assistant. In addition to training many-a-student assistant in professional skills, Vicki has recruited and retained both students and faculty with her welcoming and humorous demeanor. Both Steve and Vicki are finishing in the summer of 2020, amid fiscal contraction of UNC from a $10+ million structural deficit and the COVID-19 pandemic. The MAST Institute will also be "retired".Some stories from Vicki give you a flavor why it was such a delight to work with her—and I am sure many thousands of students fondly remember her and what she did for them:

Keepin' It Fun

My adventure in the Earth Sciences Department began in the Fall of 1979 after a couple very interesting interviews conducted by Richard Slater (Chair), Bill Nesse, Ken Hopkins, Lee Shropshire, Richard Dietz and Jay Hackett. I was asked if I liked animals, and if so, how many did I have and did I know any vegetarians. Apparently, the Department vote was split between me and another woman applying for the admin position. She had a dog – and her husband was a vegetarian. I, on the other hand had 2 dogs, 3 cats, 2 turtles, a 29-gallon fish tank and a ferret – AND I was a vegetarian. So, I won hands down! {editorial note by Hoyt: in the very asking of such an interview question the faculty clearly understood a lot about human nature and the importance of humor. I detect touches of Hackett, Dietz, Shropshire, and Hopkins in that question—and the fact that Nesse and Slater would go along with it speaks volumes about the cooperative spirit of the faculty}.

Throughout the years I've had an industrial drill bit placed on the chair in my office. It took three guys to move it. One day I went to my car after work and found that my beautiful 1967 red Firebird had been filled with leaves…and when I say FULL – I mean FULL. It took forever to clean out the leaves and when I sold the car many years later, there were still leaves in the air vents. One of my favorite pranks: I had a huge pop machine placed next to my desk in the main office. The faculty weren't very happy about that because not only was it loud – but students were coming in to use it. Most of the students weren't comfortable coming into the office – so the pranksters went around giving money to students in the hallway and told them to go in and use the machine. Plus, they posted signs saying to get pop in my office.

During the summer months at UNC, the heat was sometimes unbearable in the office with no A/C. One summer, I filled a big water gun and went up and down the halls throughout the building squirting the faculty as they taught. Some were not fans of my attempt to cool them off – but others thought it was great. I even had a faculty member surprise me by attacking me with HIS water gun. I loved it…and so did the students.

The Earth Sciences Department (now Earth & Atmospheric Sciences) has always been one of the coolest Departments on campus. Admins from other Departments have often told me that. Their faculty were boring and liked to argue with each other. We've never had problems like that and that's why I've stayed so long. In addition to having the best faculty from 1979 to 2020, the students have been amazing, too. I can be having a bad morning and feel crabby – but as soon as I enter Ross Hall and get to my office, that feeling is gone. The students have always been the bright spot in my day. Each Spring I get sad because some of my favorites graduate. But, when Fall rolls around I'm fine once again because my kids are back and I have new ones to meet! I love the fact that I've been able to keep in touch with so many of our alumni. I've made some wonderful friends over the years. Vicki and Tim at their 30th wedding anniversary in the photo.
I'm retiring in May, 2020. I've had a wonderful and fulfilling career in the EAS Department and I'm going to miss it terribly. But, it's been a good run!
-**Vicki Ouellette,** Administrative Assistant and Office Manager

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I am sure that she could have many of you arrested or fired for some of the things you did at UNC. Consider it a gift that she spared you! You know who you are…

Separate emphasis areas within the undergraduate major – geology, meteorology, general earth science, and secondary earth science teaching – were instituted in 1971, each with its own subset of course requirements, many of which overlapped. Those overlaps in requirements meant that some classes would often make large enrollments. Occasionally, graduate students would be in there too doing some graduate research and/or graduate directed studies associated with the class. Their maturity and more professional attitudes almost always raised the bar for undergraduates. In 1998 an emphasis area in environmental earth science was added to reflect job market changes to meet the needs of a changing society.

Bill Nesse made clear to the administration that these efficiencies in program offerings saved a lot of money and generally made for a better educational climate for the students. Often, students would do their own research on a topic and have an "opportunity" (assigned by the professor) to present their findings in class presentations or on a field trip. This was based on the knowledge that in order to teach something, you actually need to know something about the topic. Doing poorly on a test is not nearly as bad as appearing the fool in front of one's peers! Though there is always room for error or misinterpretation by students teaching, students also learned how being corrected is a normal part of scientific discourse. It is OK to be wrong—as long as you are willing to be corrected. Oh, how the American public (and politicians) could use that attitude in the year 2020 to learn something new.

In 1974 the Master of Arts in Earth Sciences degree program was started, primarily to serve prospective and in-service secondary and community college teachers of earth science. This highly successful program is unique in the Rocky Mountain area is and one of only a very few in the United States. It has WICHE status as a unique graduate program of the Western Interstate Commission for Higher Education. That means that western state applicants from states other than Colorado can qualify for in-state tuition rates. Another master's program that was added in 2013—the Professional Science Master's in Environmental Geosciences—enjoys the same WICHE status. More on those master's program later.

During the decades since 1970 enrollments in the Department's various programs have experienced numerous ups and downs but have in general increased steadily. Curricula have become increasingly sophisticated, rigorous, and professional; and emphasis has always been placed on facilitating students' learning of knowledge and practical skills they will need after graduation to function effectively in the workplace, be it teaching, industry, government, or other. Consequently, many Earth Sciences graduates have achieved remarkable success in their chosen professions; and employers familiar with the reputation of our department have come to us seeking new employees. Sometimes those in a position to hire are our own graduates.

The Departmental structure has had all four of the earth science disciplines (astronomy, geology, meteorology, and oceanography) in the same unit—a design modeled after the K-12 organization in Colorado and maintained in the Colorado Model Content Standards for Science (completed in 1996, and updated a couple of times through the 2020-2021 academic year). But in 2003, by mutual agreement with the Physics Department and the Dean of Arts and Sciences, we "traded" the astronomy position held by Dick Dietz to Physics so that we could hire another meteorologist. That was mutually beneficial in that our Departmental majors would still be able to take all their required astronomy courses, ESCI could hire a much-needed meteorologist, and Physics would gain the ability to offer an astronomy major track. Dick Dietz thought it was a great plan and he spearheaded much of the work that made it so. Astronomy is typically offered in college curricula nationwide in physics departments.

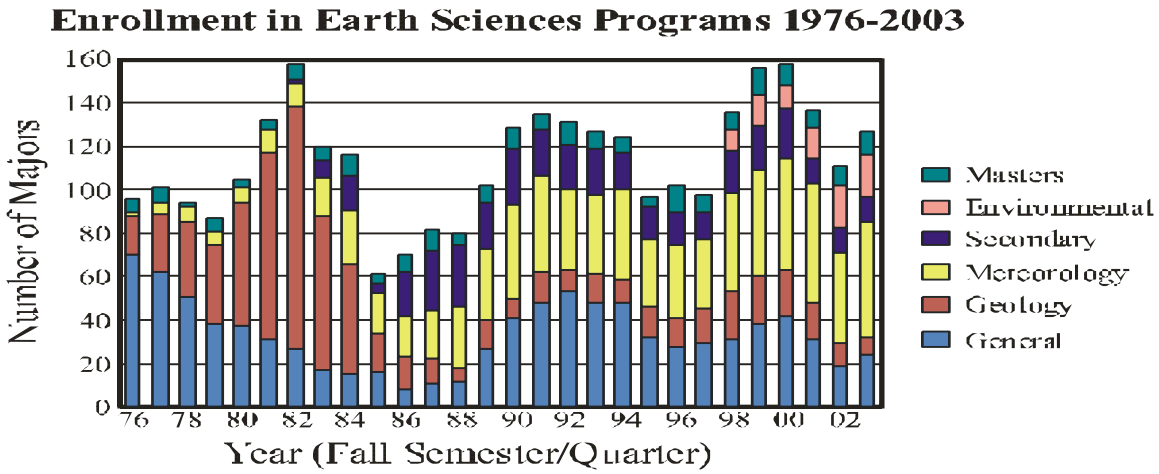
K-12 earth science teachers are required to meet or exceed Colorado Model Content Standards in the academic areas of astronomy, geology, meteorology, and oceanography. So, across K-12 certification programs, the Earth Sciences Department continues to provide needed service courses, particularly in the area of secondary, middle and elementary science. And with the 2008 implementation of the No Child Left Behind Act, K-12 earth science teachers (particularly middle and high school teachers) need to be "highly qualified" in the teaching of the earth sciences. That means they will need at least 26 semester hours of earth sciences at college. The Department has been a strong advocate for the integrity of science education programs at UNC and a leader of science education in Ross Hall. More on that critical alliance in decades to come.

Major undergraduate student enrollment in the Department since 1976 has fluctuated between about 60 and 160 student majors, distributed among the emphasis areas (see Figure below). By the way, you may notice reference to quarters/semesters on the X-axis label—the switch from quarters to semesters was made in 1987. More on the rationale and effects of that change later. From 1998 until 2003 we averaged 145 undergraduate and graduate student majors, which consistently ranked us 11th out of 24 programs in the College of Arts and Sciences. The collapse of the oil industry in 1984 caused a precipitous drop in the number of geology majors, which reached a nadir in 1988. But the increase in the number of meteorology faculty and students almost made up for that drop by 1991. With the rise of the meteorology program, the number of out-of-state students went up. From 1998-2003 an average of 29 student majors have been from out-of state, which represents almost 20%. That means we have a rather strong regional/national draw for our unique programs. Online, evening, and weekend courses characterize the past and present. Many faculty have been involved in development of cutting-edge online programs over the last 35 years, where advantageous. Since the late 1960s, teacher-professional development and various summer and in-term science field courses have been the hallmark of the Department. Why waste one of the best places in the world to learn about and participate in earth system processes? More on that later too.

After the completion of the renovation and new construction of Ross Hall in 2002 (a $43 million project) and the implementation of UNC's Charting the Future reorganization in 2005, the College of Arts and Sciences was disbanded, and Earth Sciences found itself in a new college: The College of Natural and Health Sciences (NHS). At that point the Departments of Chemistry & Biochemistry, Earth Sciences, and Physics became a gigantic School of Chemistry, Earth Sciences, and Physics (CEP). That is going to need a lot of explanation later in this document!

Even after the establishment of CEP (and its demise), the School of Earth Sciences and Physics (ESP) and its demise, then the Department of Earth Sciences again, then the Department of Earth and Atmospheric Sciences, enrollments in our major programs have remained in the range described two paragraphs prior.

That is, between 2004 and 2020, the number of majors, minors, and graduate students remained in that same range. So, one might ask what effect all the reorganizations had on the Department and enrollments—a fair question. My editorial opinion is that it was largely a waste of time which had little effect! More on that later.



The 1980s: The Cobb and Nesse Eras, and Deans Galore

By the end of the first decade (in the year 1980) there was a mature Department faculty with Ph D professors in astronomy (Dr. Dietz), geology (Drs. Hopkins, Shropshire, and Nesse), meteorology (Dr. Cobb), and oceanography (Dr. Slater, who had just departed).

Let's start the decade with a story from 1980, recounted in 2017 UNC TODAY article, then a set of stories by Bill Nesse, who became chair later in that decade. It is fair to say that the vast majority of graduates from our programs over the last 50 years have been employed in natural resources—energy, water, minerals; and the management and forecast of weather/climate for growing crops and knowing the effects on commerce. Leading that group may indeed be the energy industry.

'Raymond's Folly' Becomes Billion Dollar Success Story

February 9, 2017

From left: Bill Nesse, Bill Hoyt and Raymond Pierson review drilling logs, maps and photos of the site that Raymond has kept all these years—

Raymond Pierson smelled opportunity.

It took only a few whiffs during a UNC field trip in 1980 to convince him to act.

His UNC professors, Lee Shropshire and Bill Nesse, made a habit of taking budding geologists to a site outside of Loveland that Pierson's class was visiting that day in 1980. The outcropping there was significant for a couple of reasons. Namely, it exposed the Niobrara Formation, a mineral-rich deposit in the Denver basin stretching across the northeast corner of Colorado and into parts of neighboring states.

Students could literally smell the hydrocarbons from the exposed section known as the Codell at the base of the Niobrara.
Pierson did more than take notes about the sediment and large fossils he observed that day. An experienced oil and gas worker before he arrived at UNC, the undergraduate at the time took samples and then decided to write a research paper for a special study under Professor Nesse.
The study would become the catalyst for the big project Pierson imagined. Just six months after he submitted it to Professor Nesse on Dec. 9, 1980, it would become a signature part of his career.
Pierson came to UNC from New Mexico. There, he cut his teeth in the oil and gas business after three tours in the Gulf of Tonkin off the coast of North Vietnam serving in the Navy.
Gazing at the barren expanse of land where the pumps were working in New Mexico, Pierson puzzled over how geologists knew where to explore underground.
"It was the most amazing thing I came across in my life," Pierson said. "I asked myself at the time, 'how can they possibly figure out where to drill? They can't see all the way down there.'"
A colleague urged him to take a geology class. He did and became more intrigued. His University of New Mexico instructor, sensing his desire to learn more, recommended he further his studies at UNC.
Nesse, now retired, recalls Pierson as a "delightful" student with undying curiosity. He routinely peppered Nesse with questions. Pierson was passionate about learning as much as he could about geology so he could return, armed with an education, to the oil and gas business.
It took some convincing, and some fits and starts, but upon graduation from UNC Pierson eventually persuaded a company to take a core sample to analyze the subsurface.
One of the petrophysicists Pierson worked with before the core sample was taken asked him what they should call the project file for record-keeping purposes. When Pierson shrugged, his colleague suggested "Raymond's Folly," quipping "there ain't nothing there, and I'm not sure why you're pursuing this."
His remark couldn't have been more wrong. The core sample would reveal the presence of hydrocarbons in an area that Pierson's well log analysis found equaled 1,728 square miles (the size of eight townships long and six townships wide).
"Today, there are thousands of producing oil and gas wells in the Codell," Pierson said. "This reservoir has produced billions of dollars of product and has helped Weld County (responsible for 89 percent of the state's oil production in 2015) to be a very prosperous region of Colorado."
Academic papers have been written about the discovery, and his peers have credited him as the geologist who discovered the Codell Sandstone Oil and Gas production. Pierson laments, however, that those papers omit citing UNC as the birthplace since his study originated as part of the special study under Nesse.
When Pierson earned his Earth-Sciences-Geology degree in 1980, UNC didn't have a specific program aimed at developing geologists for the oil and gas industry. Today, UNC offers a master's degree program in Environmental Geosciences, which provides specialized training in applied sciences related to water, minerals, energy and environmental management.
"There are still big discoveries yet to be made," Pierson says. "The students today are going to be the ones making those discoveries."

And Ray's own story of how it all came to be:

"Do They Teach That Kind of Stuff?"

I grew up in the oil and gas fields and I am considered 4th generation in the petroleum industry.
After High School and serving in the United States Navy, I returned to Farmington New Mexico with the desire to become an Air Traffic Controller and continue the work I had done aboard ship as a Radarman in the Combat Information Center. Of interest is that I served on a US Navy Fleet Oiler – the USS Ponchatoula AO-148 from 1967-69. It carried 6.5 million gallons of fuel for ships and aircraft which we delivered while underway at sea. These Underway Replenishments (UNREP's) were conducted offshore North and South Vietnam. Born in the oil fields, I was amazed that I ended up on a floating oilfield.
Photo is of USS Ponchatoula AO-148 (left) refueling the USS Enterprise CVA-65 circa 1968.
As a veteran I was provided credit with the Civil Service for my time served. I filled out the application, took the exam, and was placed on the register. In the meantime, I started working in the oil and gas fields for Amoco Production Company. My job was in the field providing daily maintenance for the gas and oil wells assigned to me. One particular day I was standing next to a "well" talking to a Petroleum Engineer and asked him "how did Amoco know that 7285 feet below this location that they would find oil and gas; they can't see down there?" He said "well…geologists are the ones that figure that out." I then asked him "how could they know--they can't see down there either." He said, "well, in a way they can." I then said, "how can they do that." He answered and said, "I suggest that you go to the local community college and take a course in geology." Before that day, I was not sure that I had even

heard about geologists, other than rock collectors, or their relationship to oil and gas. I will never forget what I said to him. I was sort of a country kind of guy, and as I was standing there in my steel toed boots, levis, and hardhat with my thumbs hooked in my belt loops I looked over at him and said, "do they teach that kind of stuff?"

I took his advice and enrolled in a geology class at the San Juan campus of the New Mexico State University. The professor, Dr. Bruce Black, was a consultant to Shell Oil Company. Everything he taught just made sense. He said that if I wanted to explore for oil and gas, I should study "soft rock geology." At every opportunity I asked questions about how geologists know where to look for oil and gas. I heard answers like, "they look for traps, facies changes, anticlines and pinch-outs, and fault blocks." All these terms comprised a new language, which I was determined to learn.

The professor encouraged me to pursue a degree in geology and recommended UNC. It took a few years, but I finally made my way here. During my senior year, I was on a geological field trip west of Loveland and I could literally smell the occurrence of hydrocarbons in a sandstone named the Codell at the base of the Niobrara formation. One of the lady's that was with us that day asked what I was doing sniffing a rock. I told her that I could smell hydrocarbons and handed it to her. She took a whiff and said, "that stinks." I said no, that smells like money. As a result of that field trip, I began a research study of the area under professors Dr. Bill Nesse and Dr. Lee Shropshire, to determine the possibility of the Codell in the subsurface might be oil and gas productive. I correlated the Codell from outcrop to the subsurface and into the Wattenberg gas field just south of Greeley and I submitted the report.

I graduated from UNC in December 1980 with a degree in Earth Sciences-Geology. I was first in my class, but also the last, because I was the only one who graduated with that degree at the time. I took the report to my first job as a geologist with Cities Service Company in Denver. I was granted permission to continue the work and I obtained a significant amount of data and information. I was able to obtain a core of the rock from the subsurface and have it analyzed and confirm that the Codell did in fact contain hydrocarbons. I was working with a Petrophysicist at the time and he named the file that contained the data "Raymond's Folly." Today, there are thousands of producing oil and gas wells from the Codell. This reservoir has produced billions of dollars' worth of hydrocarbons and has helped Weld County to be the most prosperous region of Colorado. As an example, in 2019 Weld County produced 89% of all the oil and 43% of all the natural gas in entire state.

I found that in the end, yes, UNC did teach that kind of stuff. The education I received at UNC is in every aspect "priceless" with outstanding professors within the Department of Earth Science. I have enjoyed the fruits of UNC academics.

- **Raymond M. Pierson, geology, 1980; Windsor, CO**

Stories from Bill Nesse, Chair from the late 1980s through the 1990s

Getting Hired

I had been teaching as a temporary replacement faculty at the University of Idaho for about a year as I finished my Ph.D. from CU when I interviewed at UNC. I had previously interviewed at Smith College, one of the Seven Sisters colleges back east. Some of the students were favorably impressed, but it was clear that the likelihood of me being successful there was quite limited. I was a kid from a small town in eastern Washington who liked to go backpacking, hunting and fishing, and this was a posh eastern liberal establishment with a very different culture. It is no surprise that I didn't get a job offer. When I was invited to come to UNC to interview to replace Vince Mathews, I immediately felt at home. Here was a school that thought teaching was really important and had a welcoming and supportive faculty. I somehow managed to bamboozle everyone and I was offered the job which I promptly accepted after calling Marianne.

I promptly took over the responsibility to teach the hard-rock courses...structural geology, mineralogy, optical mineralogy, and petrology, as well as the usual range of introductory courses. While I had plenty of experience with structural geology and petrology, my background in mineralogy was very weak. In total, I had taken one undergraduate course in mineralogy in my entire undergraduate and graduate experience, and it was based in the, even then, archaic use of blowpipe techniques. The course I had taken in optical mineralogy was almost non-existent because the faculty who was teaching it was sick for most of the semester and all we did was a little oil immersion work. This was fortunate, because it forced me to build my courses from scratch, and because I was learning along with the students, I had a good appreciation for what they were experiencing as they struggled with the concepts integral to mineralogy.

It soon became obvious that a textbook suitable for how I wanted to teach optical mineralogy was woefully lacking. I had written an instructors guide for an introductory geology text being revised by colleagues at CU in Boulder that was published by Oxford. I casually mentioned to my editor that I wished that there was a better book for my optical mineralogy course. She promptly suggested that I write my own, so that is how I came to become the author of one of the most widely used texts on the subject.

My students, whether they knew it or not, provided a great deal of guidance in the preparation of the book. When their eyes glazed over as I presented a topic, I knew that I had to find a better way to approach it.. When the first edition of the book was typeset, Oxford used a service in Ireland, and the result was a flood of typographical errors. Despite studious effort to expunge them from the text by both myself and my editor at Oxford, errors remained in the published text. That initiated my offer to students that if they found a typo or other error that hadn't already been spotted, I would pay them. Initially the offer was $1 per error, but that went up to $5 in subsequent editions. They read more carefully and I got the errors fixed, which was a win all the way around.
The change to the semester system triggered the writing of my mineralogy book. Because we could teach fewer separate courses in semesters than in quarters, my optical mineralogy course got squeezed out and I had to fold part of it into mineralogy and part into petrology. No text then available was suitable, so my editor encouraged me to fill that gap. Introduction to Mineralogy is the result, and my students shaped that book too.

Field Trips

Colorado is one of the best places in the world to teach geology, because we have so much great geology to look at in our back yard. All the geology faculty felt that it was essential for students to have experience in the field in our courses. Saturday and all-weekend field trips were routine.
In the first few years after I started teaching at UNC, the motor pool had several International Carryall vans that we used on the trips. They were rugged and would go where we wanted but lacked in creature comforts. On one trip to the western slope, we collected some samples of oil shale that got put on the floor of the van. The muffler was directly below and radiated heat into the van. On this trip, it was warm out, and the heat from the muffler started to retort the oil shale and filled the van with its pungent aroma. The other major problem with the vans was that the motor pool equipped them with poor tires and it was uncommon to complete a trip without having to replace one or more tires on each van. We complained but nothing was done until on one trip a tire failed when one of the vans was attempting to pass a slower vehicle. While the driver did maintain control, it was a close thing. After that, a strongly worded letter pointing out the risk to life and limb posed by the tires led to the carryall vans being retired and being replaced by more conventional Ford or Chevrolet 15 passenger vans. What luxury!
During the 80s and 90s it was traditional for Shropshire and I to take extended field trips to explore the geology of some part of the region. We often went to western Colorado, but also to Wyoming, Utah, and New Mexico. The trips usually were for about a week, and we typically camped at Forest Service campgrounds or other similar places.
Lee usually was the "prime mover" for these trips and he put together an event-filled agenda. The trips usually consisted of a long sequence of stops at outcrops or viewpoints where the students would pile out of the vans, listen to some explanation from Lee or me, and then spend some time looking at the rocks. We would then pile back in the vans and go to the next stop. Unfortunately, things almost always took longer than anticipated, so it was not at all uncommon for us to pull into camp well after dark. Camp would then be set up, food cooked, and campfires lit. The next morning, it was up early, make breakfast, break camp, and be on the road. Those students who were reluctant to roll out of bed were encouraged to do so with a bit of my early morning singing. It didn't take much of that to get everyone moving. Lunch was usually at a picnic area or outcrop where we would make sandwiches.
Since we usually had a several vans on these trips to carry the students, we purchased some CB radios to communicate between vans and so the leader could describe the geology as it whizzed past the van windows. These were pretty basic radios, with a limited range, but worked well enough if the vehicles stayed within about a half mile or so, less if the road was windy. As long as the vans stayed together, they served a useful purpose.
On one notable field trip, long before the days of cell phones and GPS navigation, we were exploring the region around the Black Canyon. As usual, we were running late and it was dark before we headed for camp, which was on the north side of the canyon. Given the number of vehicles involved, it wasn't uncommon for the vehicles to get separated. To avoid losing anyone, the procedure was for each vehicle to keep track of the vehicle behind it and dawdle to allow the trailing vehicle to catch up if needed. If we turned onto a different road, each vehicle had to wait at the turn and allow the laggards to arrive before proceeding. The vehicles up ahead would then slow down or pull over and wait until we were all together again. On this trip, we took the turn off US 50 and onto the rim-road on the north side of the canyon. The vehicles waited in turn at the corner, but unfortunately, it was dark and it was difficult to identify the trailing vehicles since all you could really see was a pair of headlights. Unfortunately, one of the vehicles failed to confirm that the vehicle behind it was one of our vans and proceeded. The result was that a couple vans sailed past the turn and proceeded merrily on their way to down US50, thinking that they would catch up in due course.
The road on the north side of the canyon is quite windy, so it was hard for the lead vehicles to keep track of all that followed. After over half an hour of driving, however, it registered that we were missing some vans, so we all stopped and waited. After checking with the drivers, it became clear that the missing vans had failed to make the turn to the north rim of the canyon and that they were probably many miles away. That would be not be much of a problem now, given cell phones and GPS navigation, but then, it was a serious problem. The lost vans were well on their way to Montrose and we had visions of spending the next day looking for the lost students. We hadn't thought to make backup plans for this contingency and were contemplating headlines such as "Lost Geology Students Discovered in Nevada Desert."

Regardless of the fact that we had been separated over half an hour and had little hope that the CB radios would work, we gave the missing vans what we thought was a futile call on the radio. Amazingly, they received our call from their location on the highway near Montrose where they had been lead-footing it trying to catch up. Fortunately, from our location high on the plateau on the north side of Black Canyon, it is almost line-of-sight to Montrose. The lost vans pulled over and expressed some anxiety about where the rest of the field trip was. After getting the driving directions, they backtracked and took the rim road to the north, so we were all reunited, but not until long after midnight.
We had a full day scheduled the next day so it was up early in the morning, but it did seem that the students grumbled a bit more than usual as I roused them from their slumber. For the rest of the trip the drivers were certainly more attentive about keeping track of the trailing vehicles and we had no difficulty with keeping the group together. On subsequent trips, we instituted back-up plans for how to reconnect if vans did get lost, but fortunately never had to use them.

Program Review

Institutions like UNC periodically go through administrative paroxysms in which the constituent parts have to justify their existence. In UNC's case, this exercise was called Program Review and its primary function was to justify the existence of our administrative overlords. We periodically had to write a long report detailing our credit hour production, number of majors, and myriad other things as we justified our place in the university. The data all came from the administration, so you might think they already knew all about what was happening, but they wanted us to write it all up and tell them what a wonderful department we were. I was of the opinion that these exercises chewed up a great deal of faculty time which could be much better used actually doing our jobs....teaching, research, and service. I also doubted that anyone actually read these tomes, which could run to hundreds of pages. I had also come to the conclusion that most of the decisions would be made based on what the administrators already knew and what their prejudices were, with little reference to the documents prepared by the Departments.
While I was department chair, it fell to me to do most of the writing for Program Review. One year, I decided to run a little experiment to see if anyone had actually read the document I and the other faculty had prepared. In the middle of a long tedious paragraph, I inserted a sentence, stating that I would give $5 to anyone who got to that point in the document. It turns out that one Assistant Dean in Arts and Sciences claimed his $5, but he was the only person in the entire administration to do so.
Fortunately, we survived that Program Review, and many others, thanks in no small part to the fact that our general education courses were quite popular, so our credit hour production was always healthy. It also helped that the faculty were united in their support of each other and deeply dedicated to our students.

-Bill Nesse, Professor of Geology and Former Chair

Geology of the Red Rocks Country by Canoe (or Raft), And The Best Field Trip on the Continent

One of the Department's good friends, a Jr. High School Teacher at John Evans, owned and operated the Whitewater Canoe Company. Bernie Kendall also built a large outdoor flume model of a river system, complete with measurement systems to plot the change in the river's course as the water flowed. Bernie had been a hopeful for the U.S. Olympic team in the one-man canoe division. We used that flume for some years in sedimentology. Over the 50 years of its existence I am sure the Department sponsored more than a dozen geology trips by canoe in western Colorado and Utah; usually we put in on the Gunnison River, merged with the Colorado River, and took out at Westwater, Utah. The trips included sedimentary geology *par excellence* and usually the courses had "Geology of the Red Rocks Country" in the title. Hikes up Ruby and Rattlesnake Canyons to arches in the red rock were memorable; but most students will forever remember the fact that Bernie pulled out ice cream bars at the top of the hot arch hike (which he had kept hidden and on dry ice for 3 days)! Every night the staff would don t-shirts with tuxedo patterns on them just to keep it fun.

I have been to 25 countries and all 50 states but have yet to see a better field area to make geological and oceanographic concepts come alive for students than the Permian Delaware Basin of New Mexico and Texas. Most of you who went on the trip will remember that as the Carlsbad Trip; it included visits to modern

travertine/tufa at Sitting Bull Falls, a deep look inside the Permian reef complex in Carlsbad Caverns, investigation of underground gypsum caves at the Parks Ranch System, thick accumulations of Permian evaporites at the Waste Isolation Pilot Project or in Potash Mines, geological cross-section hike up the Wallace Pratt Geology Trail in Guadalupe National Park, and many other sites. It also included tramendous geological sites in between (e.g. K/T terrestrial boundary site near Trinidad, which is at the Smithsonian as a 1m-cube). I would also add that we went by Roswell on the way down and always stopped to satiate you Area 51 fans. Some of the best campfires were on those trips, and I am sure, the best wild caving in gypsum karst anyone in the Department has ever experienced. Thanks Ray Nance, UNC, M.S. in Earth Sciences and Chemistry.

Deans Galore

We started the decade with one of the greatest all-time Deans of Arts and Sciences anywhere: Dr. Bob Schulze. Bob was the Dean of UNC's College of Arts and Sciences and was an accomplished Sociologist. I first met him while I was interviewing here at UNC and I remember him asking me why he should hire me instead of some other candidate. Bob's feet were up on the desk, clad in his cowboy boots, and his cowboy hat was tossed in the corner. His beard was even less well-kept than mine, I dare say! I don't remember what I said in answer to his question, but I do remember Bob was delightfully challenging, a serious scholar, and one of the funniest guys I have ever known. People looked forward to reading his deanly memos—a feat rarely repeated in the history of humankind!

Most of all, Bob and Sue (a Michener librarian) believed in this University and endowed the Schulze Speaker Series and the Schulze Visiting Scholar Program. Those are some of the things I have enjoyed most at UNC all these years—I have had many distinguished geoscience scholars from around the world visit UNC classes and present interesting work in evening seminars—all paid for by Bob and Sue Schulze.

Unfortunately, Bob retired in 1982 and was replaced by Allan Bent, who didn't even last 9 months. Dean Bent would wander the campus in his trench coat flanked by a couple of "Gestapo". He called all the science faculty together one afternoon and lambasted us about how slothful and unproductive we were. Anyone who hung around Ross Hall on a Friday at 5 pm knows how offensive that comment was—and how deeply that assessment hurt. I was shocked by such negativity. It is the only time I know of that UNC paid a dean to leave.

Then there was an interim dean from the College of Arts and Sciences, and a new Dean who was hired: Theo Kalikow. She was a good dean in that she built back much of the trust that had rankled the College earlier. Interestingly, Theo came back to help UNC after she retired from being a University President in 2018. It was great to see her again. In my first year and a half at UNC, I had four different deans—not a good start to the 80s for the College. Moreover, the College had grown to be more than half the faculty of the University. Other smaller colleges at UNC felt dwarfed and not well represented. During the late 1980s and 1990s, administrative sentiment was building to break up the behemoth. More on that later. Now for a lighter remembrance!

What Does it Take to be a Geologist, Meteorologist, Astronomer, or Oceanographer?

It is worth noting that spouses and significant others who are in relationship with ***geologists*** must have a remarkable set of super-powers! Most of you can relate to the following lists. Among those are:

1) Ability to put up with long times of separation while geologists go on field excursions (it could be they welcome the break?);
2) Loss of weekends to do things around the home—geologists are always "out in the field";
3) Willingness to cede large areas in the home and/or garage for the storage of priceless rock, mineral, and fossil specimens (rock garden anyone?);
4) Independence to undertake their careers and creative endeavors separate from geosciences (distraction from the "geology is everything mindset");
5) A willingness to camp and go way backcountry in pursuit of must-see formations and geoscience wonders (why are we doing this, again?);
6) Willingness to allow rocks in strange places—inside, on desks, and occasionally in the dishwasher;
7) The telling of stories must be allowed, no matter how many times you have heard it or how embarrassing the stories might be;
8) Ability to stand around on a hiking trail while significant other takes a zillion photos of some grey rock;
9) Ability to alter international travel plans to visit some globally famous rock that requires scrambling down a steep hillside in the middle of nowhere;
10) Willingness to sort vacation photos into the 'rocks' and the 'non-rocks';
11) Willingness to work around the 'rock garden' when planting flowers in the yard;
12) Any offspring that come from such unions must countenance all the above; and of course
13) A love of beer. Almost any beer will do! Except banana beer…

The resilience and toughness of such people are a great gift to any geologist! I have had the great pleasure to know many such super-heroes! My hat is off to you.

And while we are at it, what about ***meteorologists*** (Sierra the dog has omniscience), who run toward bad weather, and are giddy at the prospect of a tornado or hurricane?

1) Considers his/her students a part of the family, so Sierra sometimes had to compete for attention. Devotes most waking hours to students - whether it's in class, during (or outside of) office hours, advisement, field trips, or the countless hours spent creating course materials and making class time the right balance of enjoyable, rigorous, hands on, and engaging. And Sierra knows this, because she's been in some classes to help keep the students 'focused' and 'motivated'… usually at the students' requests. {Sierra was a service animal who was adopted as the Departmental mascot}.
2) At least one faculty member is known to many of the students in the department as simply the "meteorology professor with the dog!" Brought Sierra to work with him most days to keep him sane, but also to lift the spirits and reduce the stress of students, faculty, and staff within the department. Sierra took her duties to heart and fulfilled her role brilliantly.
3) Has a passion for looking to the skies and pointing out cloud structures and their potential implications, whether it's in the backyard, taking Sierra for a walk or jog, or while walking around campus.
4) A confirmed computer nerd, in addition to a weather nerd - always looking for excuses, whether in research or classes, to incorporate the use of computer coding and software data visualization.
5) If only the public knew that real meteorologists are so much more than "people on TV who are wrong half the time but still keep their jobs." Sierra knew.
6) Most atmospheric scientists are one with Mother Nature. Understanding how she works and impacts human life is just part of the job, so it's only natural to immerse oneself into her recreationally as well as professionally. In addition to being concerned with the impacts of anthropogenic climate change, we enjoy Mother Nature by running, hiking, camping, backpacking, playing softball, and skiing… and STORM CHASING! And yes, Sierra participated in all these activities in one form or another.
7) Accepts relatively low pay with few fancy vacations over the years, because he or she is passionate about teaching young people and helping create the next generation of meteorologists – because these scientists save millions of lives and help change the world for the better – from combating climate change, improving the accuracy and application of weather forecasts in our daily lives and commerce, to preparing citizens across the globe for impending natural weather related disasters and catastrophes. Thankfully, knowing this is the job and having Sierra were enough, so that money and fancy vacations were never a necessity.

And ***astronomers***, those night-owls.

1) The ability to have no misgivings when your spouse says "That was a great dinner, Dear. I'm going out now. Don't wait up for me. I should be back about dawn….";
2) While the rest of the world craves crawling into bed during cold dark nights, the significant others of astronomers sometimes join the astro-crazed by sitting still outside in the freezing temperatures staring at the starry sky;

3) Pretending to enjoy the debates about whether we have a 9th or 10th planet in the solar system; yes-no-yes-no-yes
4) To Pluto or not to Pluto—that is the question;
5) Calmly discussing Armageddon with each new Apollo asteroid that is discovered;
6) Helping to criticize those movies by the name "Armageddon";
7) Pretending to follow sunspot cycles and luminosity changes with the fervor of a Wall-Street stock investor;
8) Being thankful that the sunscreen budget is way less than for other people;
9) Being irritated that the budget for "non-24" is serious bucks;

And *oceanographers*, who are all wet. Their spouses/significant others have these super-powers:

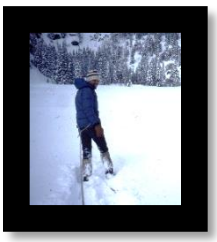
1) Must be willing to put up with weeks to months of separation while the ocean-lover is out to sea (maybe also out to lunch);
2) Must live by the water, paddle on the water, sail on the water, SCUBA dive below the water, and swim in the water—whether they want to or not;
3) Listen to endless stories about how amazing and rare water is;
4) Agree with the fact that this planet should be called planet Ocean instead of planet Earth;
5) Love beaches and the sound of waves striking the shore;
6) Enjoy getting tumbled and smashed by waves;
7) Agree that hurricanes are the coolest natural phenomenon;
8) Agree that those are tiny ripples, not monstrous waves; and
9) Know that the ocean (lakes, rivers) can kill you PDQ!

The Adventures of Field Research

There are literally dozens of stories that come out of each decade. Another one from the early 1980s was that of geology major Chris Shaw, who did an undergraduate thesis on local sedimentary formations. Chris also worked at Greeley's local ski area "Shark's Tooth", so named because of the teeth found in the Fox Hills Formation there just west of G-town along the Poudre River. The ski and tubing areas were run by former Greeley Mayor Dick Perchlick, who was a UNC faculty member. That was the last time a UNC person served as mayor. Anyway, Chris went on for a Ph D in geology at CU and has worked at Exxon-Mobil in their exploration division ever since. Present events may persuade him to retire (oil futures just went negative this week)! He was recalled from Nigeria and is in temporary quarters in Houston near the mother ship of Exxon-Mobil in Spring, Texas.

A close friend and classmate of Chris was geology major Ken Pill. He also did undergraduate research—in palynology. Ancient plant pollen can tell us much about past climates and is about the only thing that remains after you dissolve a rock. Ken went on for a master's degree in hydrology at the University of Arizona and has been working as a ground water program manager in Moab, Utah and Grand Junction, Colorado as a contractor to the U. S. Department of Energy. There are some uranium mill tailings on the banks of the Colorado River throughout the west!

Both Ken and Chris were eager to do geological research as undergraduates; when deep sediment cores in Rocky Mountain needed horsepower to the coring equipment snow. Yes, I used the platform on Bear Lake and other lakes: a



I got funding to take lakes and reservoirs in National Park, I do the work and lug through the ice and ice as a drilling condition of my permit with the Park was that I do the work in the winter when almost no one is fool enough to be out. (Well, our whole Department is out!) So just before Bear Lake iced up for the winter, I did a bathymetric map using my canoe, and then used Chris and Ken as "horses" to help with the coring. The

pictures tell the story… And a few years later we used that proof of concept to take cores of Sheep Lakes to figure out exactly when ice receding from the Pinedale glaciation left Horseshoe Park. That was master's thesis research by Eric Rainey and published in a GSA abstract (Rainey, E., Hoyt, W., and Hopkins K., 1987).

The Ice Man

Dr. Hoyt, just a short note to say hello and to thank you for all the guidance and support that you provided to me as a graduate student. I truly enjoyed my experience at UNC and will forever have good memories of the time spent with you, Vicki, Nancy, Chester, Mike, Dr. Dietz and Annapurna, and all the others faculty and colleagues. Looking back, even vibra-coring through the ice on Sheep Lakes in Rocky Mountain National Park in winter was fun, not to mention the field trips to the Black Hills and Utah/New Mexico. Importantly, I learned a lot about the Earth Sciences and life. Thank you!

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Old Man Mountain Field Courses

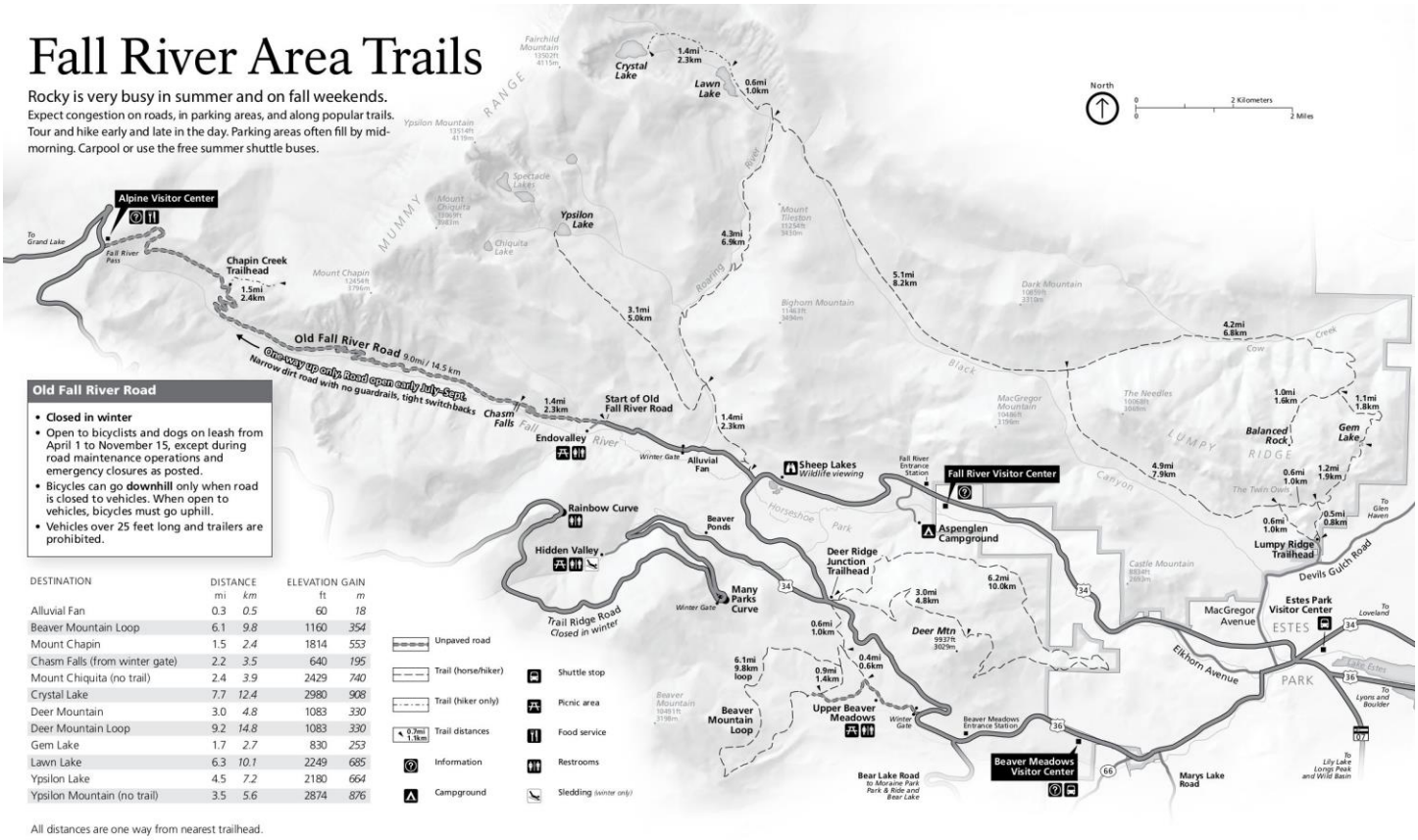
During the summers of 1982 and 1983 Dr. Hoyt used the UNC 40-acre property in the mountains to run three-week field courses for geology majors from around the country. About 50 students took that field course over those two summers. A few students were from UNC, but most were from midwestern universities that did not have their own field camps. UNC and most other geology majors of that day required a field geology camp in order to graduate from a bachelor's degree program. The rustic Old Man Mountain property was bordered on the west by Rocky Mountain National Park and on the east by the town of Estes Park. In the map on the next page, the 40+ acres of the Old Man Mountain UNC campus are just to the west of the "E" in Elkhorn Avenue. That property was ideally located adjacent to a top resort community and adjacent to the most popular national park in the country. It provided nearby a complete suite of igneous, metamorphic, and sedimentary provinces as well as one-day driving access to the Colorado Plateau and the edge of the Basin and Range. We always took an extended field excursion to one of those areas. A cook was hired from UNC food services and an experienced field geologist was hired from the University of Delaware (where Hoyt had just finished his Ph D). Ben Leslie-Bole and his wife Catherine provided field assistant services for both summers, *par excellance*.

The summer of 1982 provided considerable extra excitement during the field camp. In July, we were at the Old Man Mountain property going over an exploratory exam with the students (I needed to know what they knew and could do before we went out into the field the next day). The power went out, the phone went dead, and helicopters were flying all around. Something had happened, but in the days before cell phones, we had no idea what was up! Turns out the Lawn Lake Dam had failed up in Rocky Mountain National Park, sending a torrent of water down the Roaring River into Horseshoe Park. The warning of what was about to happen to Estes Park was given to the Park Service by a trash collector who had to do a double run that day, because his truck had broken down the previous day. So that guy, who had worked a Denver's Stapleton Airport, was there at daybreak, witness to a colossal flood. He described the noise to the Park Office as "that of a jet taking off". Of course, they did not believe him, and had to verify this fanciful and terrifying tale. It was true, and the police evacuated the town of Estes Park before the Fall River flood arrived in the town.

Because of quick and wise action, no one was killed in Estes Park—and the Old Man Mountain property was safe, hundreds of feet above and thousands of feet away from the Fall River. So, we were safe, but the bridge

across the Fall River was gone (as well as the house on the corner). There was $31 million in damage to Estes Park, and three people up in the Park were killed. There were a couple of guys backcountry camping on the banks of the Roaring River just downstream of the Lawn Lake Dam that had failed. One of them was a light sleeper and scrambled out of the way just in time. His buddy was not so lucky, the first fatality.

The other two fatalities in the Park were in the Aspen Glen Campground, where all the campers had been awakened and evacuated to safety. But two foolish people could not resist the chance to retrieve their tent and camping gear. When the Cascade Dam failed catastrophically just above the campground, those two died as well. It must have been an horrific death.

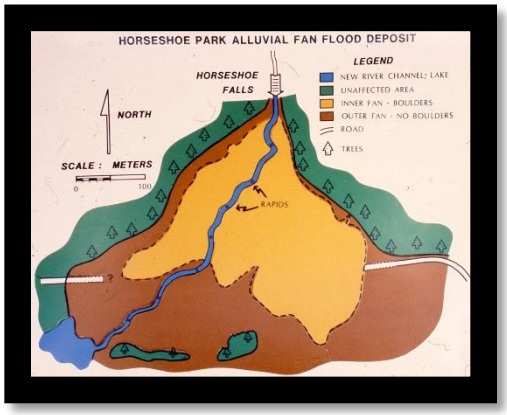


The liability wrongful death lawsuits that followed identified three entities with responsibility for the catastrophe: the State of Colorado (for responsibility for Dam inspections in the state), the farmers co-op that originally built the dam for water storage (before the Park was established), and the National Park Service. Almost all the responsibility for the calamity was assigned to the State of Colorado and the farmers co-op. the problem was that the State of Colorado has a maximum liability for anything it does of about $400K; and the farmers co-op had been dissolved decades earlier and had no assets. So, the Park Service, who had <3% responsibility, basically was on the hook for all the financial damages. Not sure that is exactly how it worked out. At any rate, the two people who reentered the Aspen Glen Campground against the direct order of the Rangers had no case. The person's family (the guy killed just downstream of the Lawn Lake Dam) did collect on wrongful death, but almost all the $ came from the feds, despite their trivial responsibility.

Meanwhile, back in Greeley and across the country, the first limited media reports out of Estes Park about the flood calamity were very dire—loss of life was greatly exaggerated and Chair Glen Cobb back in Greeley was fielding lots of phone calls from parents wanting to know what had happened to their college student at the

UNC property in Estes Park. Was anybody alive? Could you please retrieve my daughter's remains? Poor Glen! He did not know the real story and there was no way for him to get the information. Knowing the likely situation Glen was facing and feeling the angst all of us at Old Man Mountain, I made the quick decision to evacuate from Estes immediately via horse trails with the UNC vans, and get to phones in Allen's Park (likely the closest phones that were working). We quickly packed up all the food and camping gear we would need for our geology excursion to western Colorado and Utah, traversed trails with the vans, and got to the phones by mid-afternoon. After all of us got word to our families and to UNC; we enjoyed being away from Estes Park for several days! By the time we got back there was an easier way to get back to Old Man Mountain.

Two of the students in that field camp wished to map the newly accumulated "alluvial fan" for their field mapping project. That deposit, just downstream of Horseshoe Falls, deposited enough sediment to fill the Orange Bowl and is chronicled in a publication "A Geologist's Perspective of the 1982 Estes Park Flood" (Hoyt, 1987). I suggested that the students could use the Elk "barking" on the aspen trees as a datum plane for helping to figure the volume of the deposit. Geologists will use whatever tools that present themselves! The Elk eat the photosynthesizing Aspen tree bark in the winters for sustenance, and the biggest of them reach up to a certain elevation on the Aspen trunks; by measuring 100 of the highest marks on 100 trees, we could get a pretty good datum plane to help estimate how much sediment accumulated during the flood by measuring the distance from the top of the barking marks down to the sediment surface.



I remember inspecting the "alluvial fan" a few days later (better called a debris flow fan) and hearing a couple of know-it-alls nearby describing how boulders must have been flying up out of the debris flow and knocking the tops off the many topless 80-foot pine trees. Well that's a tall tale, better explained by the Oscam's Razor explanation that boulders smacking the *base* of the tree would whip the tree so violently that the tops would be whipped off. I didn't have the heart to wander over and suggest an alternative in the midst of such certainty.

The Park Service repaved the road later that summer of 1982 across the fan so that you could drive up Fall River Road (you can see the discontinuity in the road in the figure above). Too bad the winter of 1982-83 was a record El Nino-induced snowfall in the Rockies, and the spring runoff destroyed the road again. The Park Service had no way to know back then that it would likely be a big El Nino year. Now we might have some premonition! My Ph D advisor Dr. Chris Kraft visited us at field camp and loved seeing territory different from his usual sandy coastal lithosomes.

As with most extended field excursions, the summer 1983 field camp at Old Man Mountain was not without its adventures and issues. One of the cook's duties every business day was to walk or drive down to the Estes Park Post Office to get all the camp's Post Office Box mail. You old timers will know how important that was, and the excitement when a "care package" would show up. Anyway, this particular July day, a thunderstorm was brewing, but undeterred, the cook hoofed it down to the P. O. Box. On the way back, lightning hit a nearby tree and knocked him out (and knocked out some of his teeth). Though not seriously damaged by the strike (he was about 50 feet away from the tree), his duties were curtailed, and we figured out how to cook on our own for the rest of the field camp. He did spend the night in the hospital. What a bummer!

Later that 1983 season, on our trip to Utah, we stopped for a good look at the Colorado National Monument stratigraphy. Coming down off the Monument, the rear brakes on the UNC motor pool van failed with metal-to-metal grinding. I suspected the brake shoes were gone and we were wearing into the drums. It was Sunday and Grand Junction repair shops were closed, but I did find replacement shoes and seals I would need to do the job. We lost a half-day to Hoyt mechanical services. When I pulled the rear drums off I was horrified to see just how far the drums had been scored, apparently for quite some time. There was no way the drums could be turned to remove the grooves (especially on a Sunday). It also was clear that the original factory-installed hardware was still there, despite the fact the van had almost 90,000 miles on it. In other words, the brakes had not been checked or replaced since UNC bought it many years before! I patched up the brakes with new shoes and adjusted them to lightly apply until they broke in. We had a safe and uneventful trip out to Utah and back.

When I got the vehicle back to the motor pool, I was told that they didn't check the rear brakes because they would have had to replace some axle seals as well (too much trouble for them)! It was then that I bought my own 15-passenger van that would be properly cared for (it was a used airport shuttle van that had a new short-block engine installed and new Michelin tires). Some of you will remember that van because it was tan and brown-colored instead of UNC's institutional white vans. And some years we rented vans from a local Greeley rental car place but had bad luck with those vans vapor-locking (usually at Colorado City on the way to Carlsbad or on some deserted New Mexico or Texas roadside full of scorpions). With the bottom dropping out of geology enrollments by 1984, that field camp went away, and has not returned in that form. We now have a combination of field camp and/or internships for geology major requirements.

Fortunately, when the 1990s rolled around there was a change in Motor Pool staff and the National Transportation Safety Board had issued some safety guidelines about those vehicles due to their high center of gravity. Later, in the decades of the 2010s the US passenger-van makers finally went to the low center of gravity designs the rest of the world had been using for many decades. But, we still need high ground clearance for our backcountry sites, so the Department arranged to get one of the older white vans assigned to our Department for our exclusive use. With the University shut down now, there are no field trips and the financial deal looks less appealing! Oops by Hoyt! Department decals on the van to the left.

The Friendly Office to the Friendly Skies

I have the best of memories at UNC and in the Earth Science building. I was fortunate to see Dr. Cobb before he passed. All my Professors were very inspirational in my moving on to a wonderful career. After flying as a pilot in the U.S. Airforce for 25 years I now fly for United airlines out of Denver. Not one final approach goes by, when landing south, that I don't look towards Greeley and remember how I got to where I am today. Thank You!

Rick Revell, Class of '86, Meteorology

Interestingly, another pilot who graduated from UNC has quite a story that was made into a Hollywood movie: SULLY. Played by Tom Hanks, the 2016 movie detailed the story of the emergency landing Sully Sullenberger made in the Hudson River after birds were ingested into the engines of his commercial jetliner. All survived that (well, not the birds). I wonder if Glen Cobb or Les Trowbridge had him in MET class? I never asked either of them. It might be in Sully's book.

The Nesse Years: 13 Years at the Helm

Dr. Glen Cobb continued as Chair of the Department through part of 1987 and was the lone meteorologist. That overwhelming academic and administrative load, and running a few head of cattle, led to Dr. Bill Nesse taking over as Chair in 1987. Both chairs took on immense administrative responsibilities during their tenures and shielded the other faculty from as much administrivia as possible. With the drop in the number of geology majors in the mid-1980s it was also a good time for Nesse to become chair. He kept that role 13 years, which at the time was the longest-running tenure for department chair in the College of Arts and Sciences. Since 1987 was also the year the transition from quarters to semesters was implemented, Nesse's considerable administrative abilities were put to the test.

The typical teaching load per quarter for each faculty member was about 4 courses per quarter, or 12 courses total during fall, winter, and spring quarters. Summer quarter was optional, but many took on grants or other UNC-related teaching in order to pay the mortgage. In those days we were paid over 9 months for our 9-month jobs. When we went to the semester system, we also went to a typical three-course load per semester. So suddenly we went from each faculty member teaching a dozen courses per academic year to half that in an academic year.

Construction to Geohydrology to Minerals

I came to UNC the fall of 1982 at the ripe old age of 22 years old. I had previously worked construction and at an anthracite underground coal mine near Redstone, Colorado. When the coal mine laid me off, they offered to pay for me to go to college. My initial plan was to attend UNC and later transfer CSU and study construction management. My first quarter at UNC I completed an Earth Science general education class and thought it was interesting, much more interesting than the several business management classes I had previously taken. The third quarter I signed up for Physical Geology with Dr. Nesse and at the end of the quarter I changed my major to Geology.

The geology department at UNC was most helpful to get me through the program. My math skills were so lacking I had a math class almost the entire four years at college. I loved math and took a lot of math classes! The things I remember most about my geology classes were the time I spent in the Ross Hall basement laboratory looking at fossils for Dr. Shropshire's paleontology class, looking at slides for optical mineralogy and petrology classes taught by Dr. Nesse, and finally all of the field trips to look at geology, especially the spring trips led by Dr. Hoyt to Big Bend National Park and Grand Canyon National Park. It is amazing to look back at my undergraduate years and realize that computers, CAD, GIS, email, Google Earth, Zoom, ….. did not exist. I made a lot of friends at UNC and although I do not get to see many of them much anymore, I think about them often. I cannot remember the name (Vicki?) of the hot secretary that worked in the geology office, but I miss her too. Just kidding; I remember her name! {The photo to the right of Chester was labeled "Social Distancing in the Green River Basin". HA!}

The knowledge gained at UNC helped me prepare for a career in geology. I went to graduate school at CSU and began working in 1988 as a hydrogeologist. I have had the opportunity to travel all over the western United States working on contaminant hydrology, water resources, land reclamation and mining projects. I went back to school in 2006 and received a degree in 2010 in Land Surveying and Mapping. I currently work as a consulting field geologist/land surveyor in the mining industry for Wenck Associates in Fort Collins, Colorado. Between 1994 and 2014, I taught hydrogeology at UNC during the spring semester every other year. I enjoyed teaching and it was amazing how much more I had to learn to be able to teach the subject.

I am getting older now and hope to retire in the next year or so. Working in the -25°F weather in the Green River Basin or driving to Montana to look at a frac sand deposit is starting to wear on me. My retirement plans are to move a small town in the Colorado mountains and ski, mountain bike and fly fish until I die. My hope is they find me frozen to death in my cabin at age 100 years old with a half-full glass of single malt scotch (Lagavulin 16 Year) in my hand. I would also like to learn to play the guitar and buy a nice guitar from Dr. Nesse, but I have no music talent so that probably will not be happening, but you never know!

Chester A. Hitchens, Class of 1986, Geology
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Many courses had to go, and many others were combined. The curriculum in each area was overhauled. On the chopping block were courses like biometeorology, marine geology, coral reefs, economic geology, geochemistry, and others. Some courses, like historical geology, had been offered in a two-quarter format. In the semester system it was now offered in a single semester. So, 20 weeks of instruction (two 10-week quarters) were condensed into a single 16-week semester. Sedimentology and Stratigraphy were two separate 10-week courses in the quarter system. Now they were combined into a single semester course. Arguably, the 10-week quarter format had two decided advantages for students: 1) in a 10-week format there are no doldrums—no time to dilly-dally and get behind; and 2) separate offerings of centrally-important topics for professionals are more numerous and more varied. Nevertheless, the rationale for going to semesters was that all the other major universities had done it. Only community colleges remained with the quarter system. It was a done deal!

SCUBA Club and Department Trips to the Caribbean and Mexico

Chris Shaw and Jeff Hegarty were both majors in the Department in the early and mid-1980s. Chris got his SCUBA instructor license, and for several years we ran SCUBA certification programs out of the Gunter warm therapy pool on the old campus. That allowed many UNC students to get certified, some with open-water dives at the Blue Hole near Santa Rosa, New Mexico. The UNC SCUBA Club was run out of our Department, and we made full use of the Student Representative Council subsidy for student training off campus. We took spring break trips with the SCUBA Club, professional geology organizations, and the Department to Montego Bay, Jamaica three times (Univ. of the West Indies), Belize, Grand Cayman, and Cabo San Lucas, Baja, Mexico. Alas, after years of decent UNC support, those subsidies for the students dried up and it just got too expensive. And after Chris graduated, the Gunter Pool was filled in to make a gym. Eventually, we were also prohibited from using the Recreation Center pool, so that SCUBA program largely went off campus (to the Tortuga Bay SCUBA shop on U.S. 34 business). Ron Bland certified many UNC students in following years, in the deepest warm, salt-water pool west of the Mississippi.

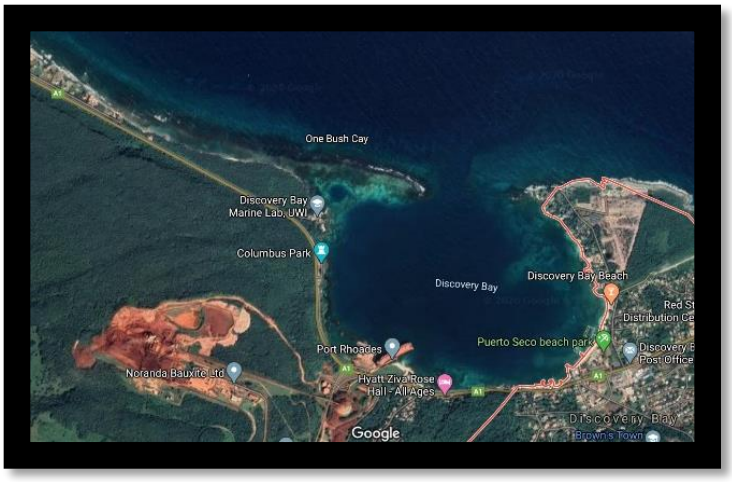
Several of the Montego Bay trips and the Belize trip were helped by a graduate student I had in those days interested in coral reefs: Bill Precht. Bill worked at an energy company in Denver and enrolled in my coral reefs course. I dare say he knew more about coral reefs than I ever will! He went on for a Ph D program with Bob Ginsburg at the University of Miami and has written extensively on coral reefs. I had lots of interesting diving adventures with him, one time waking up a shark around the far side of a coral bommie in Belize. The captain of our vessel had hit a shallow coral formation, which yanked the drive shaft out of the engine. After trying to hammer the drive shaft back where it belonged (with a pressurized steel SCUBA tank!!), we changed our research plan for the day. With the shark and the SCUBA tank thing, I could have been killed twice that day (think Jaws).

One more SCUBA story with Bill Precht in Discovery Bay, Jamaica is worth mentioning. There is a Google map on the next page that shows the Discovery Bay Marine Lab, University of the West Indies, the bauxite mine (aluminum ore), and the location of this SCUBA cave story (about where the word “Seco” is). Bill wanted to show me one of Discovery Bay’s many wonders. Because of the karst topography and high rainfall in Jamaica, Discovery Bay mixes fresh water and saltwater, producing wide ecological niches for about 400 species of coral, and unusual underwater caves. In one of those caves was a rare and seclusive sclerosponge. Those sponges grow in the dark, where there is little competition from other organisms that depend on photosynthesis. The sclerosponges feed on zooplankton and phytoplankton that circulate through the cave darkness.

In order to be as safe as possible cave diving of those days required three things:

1) A lifeline rope, one end of which was tied outside the cave entrance and the other end tied around the diver's wrist;
2) A trusty underwater light to be able to push back the total darkness; and
3) A dive buddy whose job it is to look out for you and assist if you get in trouble.

A three-fold chord is not easily broken; the redundancy and contingency plans in such a safety system are instructive for us in living the rest of our lives above the waves. It is always better to plan and act as if you will need more than one way to solve a problem. If you depend on only one way to solve a problem, and that way fails, you are SOL. Another way to think about this lesson is to think about building margin into your life—when things go wrong, you would be wise to have resources at your disposal: extra time to work through things, extra money to tide you over, extra friendships to encourage and counsel you, and extra spiritual resilience to help with everything else. Like earthquakes, tornadoes, asteroid impacts, hurricanes, and tsunamis, it is not a matter of "if", but rather a matter of "when"!



Speaking of fresh water flowing through the ground, that water is used by the Red Stripe brewery near Montego Bay. Some of the UNC SCUBA Club students in the photo to the left are enjoying a Red Stripe on the tarmac before flying back to Denver, circa 1983. Oh, and on that crazy underwater cave dive, we had a couple more backups. A boat was anchored with another diver who could come get us (maybe), and an underwater camera I was taking pictures with so that at least someone might have clues what happened to us if we did not make it out.

Kent Becher, who graduated from UNC in 1988, has some remembrances that characterize the decade well:

Professors Care About Our Education

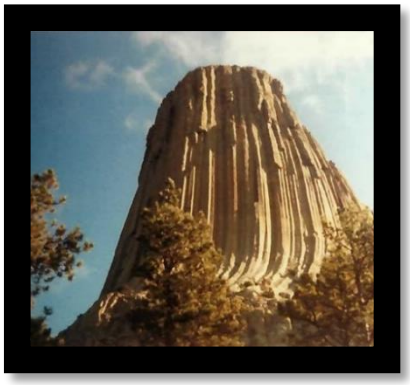
Congratulations to UNC and the Earth Science Department celebrating 50 years of explementary teaching of various science majors who have moved on to the world to make a difference. I have very fond memories of my four years at UNC (1984-1988). I studied under Dr. Nesse, Dr. Hoyt, Dr. Shropshire, and Dr. Hopkins. It was obvious from day one in the classroom with these fine gentlemen that they cared about our education. In larger universities, the professors typically are more interested in finding research funding than teaching and most of the classes are taught by student assistants. Our class sizes were small, there was a lot of one on one teaching for the students. It was extremely easy to find one of the professors if you had questions outside of class and they took the time to work with you. I remember one time we were talking about the Fox Hills Sandstone in class and the next thing I know we were in a vehicle with Dr. Hoyt to look at the formation in person instead of in class.

There are plenty of good stories to tell from the classroom and from the many field trips. I remember in Dr. Nesse's mineralogy class he used to talk about not letting another student lead you on about mineral names during the class. He used me as example and said Kent might think this is spodumene and it may not be that mineral. Of course, from then on anytime he held up a mineral I would then say it was spodumene and the next thing I know my classmates nicknamed me "spod". So, we are on a field trip month or maybe even a year later in the Black Hills and we are looking at the massive pegmatite dikes in the area. Dr. Nesse points over to

a large crystal on the edge of the pegmatite and says what is that. I yell spodumene and he says hey your right. We all cracked up on that one.

I believe I was in Dr. Nesse's mineralogy class on January 28th, 1986 when the Space Shuttle Challenger blew up. I remember we stopped class and watched the horror on TV.

One of my favorite things we did was our field trips like to Black Hills, Badlands, Permian Reef Complex, Carlsbad, and National Parks. I remember arriving in northeast Wyoming late one night and we set up camp in the dark. I had to use the restroom and I went out in the woods and I tripped over a log. When I lifted my head, I could see the moon light on Devil's Tower. I will never forget seeing that incredible geologic structure that night. On the same trip, I learned that Dr. Shropshire was just nuts over Dinty Moore Stew. I think he ate that every night. Then we were in Custer State Park and I was driving Dr. Shropshire's truck and we had some bison on the road that would not move. He said blow your horn at them and I did, and they would not move. He said bump them with the truck and I said are you sure and he said do it. Well I bump into this Bison and he turns his head and nails the front part of the truck. A little later down the road we had a leak in the radiator and Dr. Shropshire had me chewing gum to stick in the leaks in a radiator. See I learned more than geology that day but learned you can use chewing gum to fix a radiator or maybe even better yet, do not mess with wildlife. To the right is Dr. Hoyt at the turbidites of the Bell Canyon Fm., Wallace Pratt Geology Trail, Guadalupe National Park.



I will end this with two more memories from my days at UNC. I was supposed to work at the USGS in the summer of 1987 and at the last minute they cancelled the situation for the summer. Anyhow, I am in my geomorphology final and Dr. Cobb walks in and says to come see him after the test. He tells me he knew how much I wanted to work that summer at the USGS, but he had a great opportunity for me to head to Alaska for the summer to be a part of the Juneau Icefield Research Program. He had a colleague at NOAA in Boulder who was on that team and they were looking for a geologist student to join the mission. Dr. Hoyt and Dr. Cobb wrote up recommendations to the program to accept me and the next thing I know I have an NSF scholarship and am heading to Alaska for the summer. I crossed the Juneau Icefield over a two-month period where I studied glaciology, glacial hydrology, and bed rock geology. It was an adventure of a lifetime and thanks to my caring professors at UNC they made this possible for me. I even received college credits from the University of Idaho and University of Alaska Fairbanks for my research up on the ice.

I will never forget my senior mapping project. I remember the endless hours mapping out my area near Carter Lake avoiding the rattlesnakes along the way. When Dr. Shropshire graded my mapping project, he said that I had some bad interpretation on some of my geology. He said I identified some geologic formations near Carter Lake that were not located there. I told him I am sure that it was there, so he agreed to go look in person with me. We get out there and he says what do you know it was located there. The water level had dropped in Carter Lake, so you could see the formation where the water used to be. Where else could you go to school and go out to a location with your professor and prove what you found was there.

As usual when I was a student, and even today as a professional, I am very long-winded on my writing and presentations, so please cut this down, Dr. Hoyt, to what you see manageable as you see fit. {editorial note by Hoyt: I challenge anyone to diagram that sentence! Very clever of Kent to demonstrate what he is saying so graphically.}

I am grateful to UNC and my professors who taught me there. I had no idea what my world would be like after graduation. I have been with the USGS for 32 years now as a hydrogeologist and I have been blessed to have been able to study so many different things in regard to surface water, groundwater, emerging contaminants, water-quality, uranium hydrology, solvent transport, well design, and so forth. I never dreamed I would become a senior scientist for the USGS and I have been in that role for many years where I manage numerous studies. My education from UNC provided the background for my career and I am and always will be proud to be a UNC Bear.

-Kent Becher, geology, 1984-88

Honors Program and Undergraduate Thesis Projects

During the late 1980s and into the first decade of the new millennium, UNC had strong institutional leadership for the undergraduate Honors Program. UNC had acquired a grant from Colorado's Higher Education

Commission to develop general education MIND courses that any student could take but would be required for Honors students. Those courses had *two* professors from different disciplines teaching the same course (funded by the grant), and all those courses considered complex interrelationships between different disciplines. The one I got involved in creating was "Revolutions in Science" which I taught several times with professors from biology, chemistry, physics, and even philosophy. We considered how paradigm changes in science happen, and studied cases such as the Copernican revolution, the germ theory of disease, and plate tectonics. Most students loved having a very different kind of course—but MIND classes were much more difficult than typical general education courses. Some students, usually science majors, had a very hard time accepting that scientific theories could ever be replaced—causing them to drop the class.

There was also a requirement to take a 1-credit Honors Seminar—again with a pair of professors doing "outside the box" things. One I did with Miguel Fernandez-Balboa (a critical pedagogist in sport and exercise science and a native of Barcelona) was on "Change and the Human Prospect". We met in the Honors House, which had a fireplace. After carefully going over the paper syllabus we gave the students, I collected the syllabi (!!) and proceeded to burn them in the fireplace. It was clear that we were giving the students the responsibility to choose and analyze the topics for the "Change" course. There was a long silence before they realized we were dead serious. Most Honors students were rule-followers, and we just broke a bunch of rules. The other end-of-course rule we broke was that we had a discussion with each student about what grade they deserved in the course. That strategy was stolen from Lee Shropshire. Since most students were straight-A students, those were some interesting discussions if they were slackers in the course.

The top students from across the University were eligible, and we had many who took up the challenge. However, many others started the program, but found that the extra work (on top of their job or major or intercollegiate athletics) made it too much. That was especially true about gathering the research wherewithal to do a thesis. Some of the theses I supervised were:

- Richard Patterson, General Earth Science, "The Greening of German Environmental Awareness"
- Paul Stanko, Meteorology, Lightning: Atmospheric Switch or Battery?
- Chris Jones, Meteorology, Wyoming Snowmelt Dynamics
- Nikki Marchman , Environmental Earth Science, St. Vrain River Water Quality
- Sandra Mader, Geology, Environmental Attitudes of College Students

In many ways, the Honors program prepared students for graduate school and most of them did just that. You will notice that there are no teaching majors in that list—their courses for their 4+ years are prescribed, with almost no room to do something like the Honors Program without adding on a least another year of college. Tough sell. But for me and several students, being in the Honors program was the most fun I had with others in the UNC community!

Stories from Nancy Linscott

Ahoy! How fun! And how great to hear from you after all these years. I just saw that Vicky just retired or is retiring--I can't believe how long she's been there. Wow.

I love your challenge, and the timing is great, because just a few days ago, I was up in the mountains west of the town where I live (Hailey, Idaho), bumbling around an old mine site, "socially distanced," of course, doing my usual thing: hiking along, kicking rocks, whatever (I enjoy studying the locally geology for fun and for teaching my kid her at-home earth science lesson for her 8th grade online class), and for some reason totally out of the blue, something pinged across some long forgotten synaptic gap in my brain

and fired up a very obscure memory from my time at UNC. This might not really "fit" with your request, but it's fresh in my mind, so here you go.

At some point, I had a work-study job in the department and Dr. Shropshire had me preparing rock samples for the classrooms. The process involved breaking up big rocks into smaller, fist-sized "hand samples," painting a small splotch of white paint in a space on the rock that didn't obscure any important granular or mineralogical feature of said rock, letting it dry, then meticulously painting a number on the white splotch, and finally applying a clear coat of nail polish atop the number to secure the labeling forever more. Dr. Shropshire was very, very concerned that I get this right. He seemed unconvinced that I could pull this off properly, probably because I was rolling my eyes a bit too much at the pace with which he was describing the task and the degree of detail he was providing to make *doubly sure* that I understood the critical nature of the assignment.

He finally, *finally* left me to my own devices. Me, a large-ish boulder of quartzite, and an apparatus that looked something like a hefty tire jack of some sort. Nancy vs. the Rock. All this would have been well and good had I weighed a bit more than 105 pounds. I recalled sort of watching the back of Dr. Shropshire's head disappear from wherever we were--somewhere outside the basement zone of Ross Hall, maybe? I can't quite get that part of the event into clear focus. But there I was, Miss Smarty Pants, "yeah-I-get-it-already" staring down a rock that outweighed me, just daring me to break it into, oh, say 50 or more small pieces meeting ol' Shrop's detailed specifications. I can do this!

Mmmmm . . .Not so much so. Just getting that boulder wedged into the jack-like breaker-upper tool involved pushing, panting, wedging, using my legs as a brace, and then throwing my remaining body weight down on the lever, and. . .NOTHING. Not a chip, barely a poof of dust came off that stupid boulder. Go get hammer. Beat on rock. A chip here, a chip there. Nothing coming close to a friggin' hand sample. I'm now probably half an hour into it. I've probably got another class to go to or a boy to hang out with (my heart throb Eric Rainey), or a beer to drink. Who knows? Shrop wanted, what? Fifty samples out of this thing? Are you kidding me? I see the nail polish, the fine-pointed ink pen, the clear coat, all lined up on the ground nearby. Yeah, right. Fifty.

Finally, I think it may have been Ian Baker or some other burley, corn-fed kid {was it Dean? Yes, editorial note from Hoyt—I am almost sure it was Dean Gaddy} from the department toodling around nearby, and the spectacle of my efforts must have aroused his curiosity, because he stopped, watched me for a while, and finally offered, "whatcha doing?" I explained the situation, grumbling about the ridiculousness of the task that Shrop had set me up to and how stupid it was. In hindsight, I'm pretty sure the whole affair was intended as a different sort of lesson--one in humility, perhaps--that Shrop wanted to impart on me for some reason. The burley Dean ambled over, deftly wrenched the lever down on the boulder, breaking off numerous pieces like it was nothing, and I began the process of affixing the labels to them. {Another editorial note about Dean: he did not like writing at all when he arrived at UNC, but after he finished his geology degree, he took a job as Editor of *Offshore Technology Journal*. How ironic, but it does show just how much a UNC degree can transform a person!}

Somewhere in that building probably to this day, there's a drawer full of quartzite hand samples sporting my handwriting on them. They've been scrutinized with a hand lens, abused by hydrochloric acid, scratched, streaked, and sketched by 30-some ott years' worth of would-be geologists and earth science teachers. I hope they passed the test of time!

Then, I have a whole album full of pictures, some of which may spark a more appropriate recollection than just Nancy trying to smash rocks. I'll dig through them and send them in. I have a bunch with you, Eric, Chester, a guy named Mike Smith, on a field trip to the Grand Canyon, and some up in South Dakota, circa 1987-1988.

Over and out from Idaho--A great place for staying apart.

{On a completely separate topic, Nancy also recounted one of those “memorable” (harrowing) rides with a fellow student for Thanksgiving Break}. Some excerpts from the “Cow and the Indian” story:

The 18+ hour ride home was disastrous. Though he (who shall not be named) never attempted to hurt me deliberately, he was a horrible driver in every sense of the word, and it was a horrible car and I've never been more terrified in my life. After we were past the point of turning back, he pointed out to me that he had a loaded pistol in the car--a Datsun that was old even then. "In case anything goes wrong," he explained. I realized then that Dr. Shropshire’s suggestion that I find another way to get home was probably a good one. The “car”, I might add, was so old and rusted out that it had holes in the floorboards where you could see the white stripes roll by, and no functional radio, so he had also thoughtfully brought along his trusty harmonica for entertainment. He never played an actual song--just whiny inhales and exhales of various notes. But that in and of itself wouldn't have been a big deal, just an annoyance. And I was a bit sketched by the gun, but if it stayed under the seat, I was sort of "okay-ish" with that. Remember, back in those days of course there were no cell phones, and we're in the middle of nowhere, so it wasn't like I could really do anything about the gun situation. And in either event, it was the run-ins the Cow and the Indian that I found more troublesome. {Details of those stories are a bit graphic and have been edited to protect the innocent! So, after some adventures….} I finally insisted on taking the wheel after he almost missed the T in the road (which would have sent us off into the abyss, Thelma and Louise style). Of course, by then I first had to pry my fingernails out of the dashboard! I made a mental note to thank Shropshire when I returned for at least trying to warn me that he had a bad vibe going on about that student.

-Nancy Linscott, geology

They Are the Nicest People

Hi Vicki,
It was so nice to see your request on LinkedIn. I'm not active on that site, but when I saw a message from Vicki at UNC - I wasn't sure if it was the Vicki I remember. Apparently you are. You were always so nice and pleasant and helpful to a kid from NY. Truly loved the year I spent in the grad program there. Professors Shropshire, Nesse, Hopkins, Hoyt and of course, Dr. Cobb -- they were all so fantastic (as were all the others I had contact with). It was one of the best experiences of my life -- grad school at UNC.
I retired 2 years ago, after 40 years of teaching Earth Science, 38 years here in Cobleskill. I was actually just hired to replace a teacher who left in October, in a small city school in Albany. It was quite fun to be back in the classroom. I actually found a replacement, a young kid who went to my undergrad school. He graduated in December and took over for me in January. He's going to be good, very enthusiastic, tech savvy and passionate about Earth Science. I see myself - 40 years ago - so I'm very excited to watch Ryan develop and have a wonderful career.
I think of Greeley often and have been watching the news closely, regarding the meat packing plant and Covid-19. Everyone there was so nice to me, I just have the fondest memories. I hope you stay safe and well. I highly recommend retirement - finally a chance to read (for pleasure). It's been a nice transition for me and I'm sure it will be for you. Congratulations, take care.

Brian LaVine <lavineb@crcsd.org>

The 1990s: Growth and Stability with Storms Brewing

MET Becomes *Mas*

In the 1990s, Meteorology had really come into its own at UNC, with 50 MET majors and two great faculty toward the latter part of that decade: Cathy Finley and Bruce Lee. The "draw" of those two faculty is best described by a more recent article from a University of North Dakota story where Cathy Finley and Bruce Lee are now on the faculty:

By Patrick Miller
A state-of-the-art computer model simulating the supercell thunderstorms that spawn the largest and most destructive tornadoes have atmospheric scientists questioning the widely accepted concept of how tornadoes form.
What we think we know about how and why tornadoes form could be wrong.
Catherine Finley, assistant professor of atmospheric sciences at UND, is collaborating on a National Science Foundation (NSF) project with Leigh Orf, associate scientist with the Space Science and Engineering Center at the University of Wisconsin in Madison, and Bruce Lee, managing atmospheric scientist of High Impact Weather Research & Consulting LLC.
They're using an atmospheric model run on a supercomputer to simulate supercell thunderstorms that typically spawn the strongest, largest, longest-lasting and most deadly tornadoes.
Given that roughly three-quarters of the tornado warnings issued by the National Weather Service are false alarms, the ability to recognize and detect signs in the atmosphere leading to the formation of a tornado could result in more reliable and longer advance warnings — warnings that save lives.

"This work is really groundbreaking because when you're out in the field — and I've actually done some observational research in tornadoes and severe storms — almost always prior to tornado genesis, you see the development of what we call the rear-flank downdraft," Finley said.
Those who watch TV shows or YouTube videos about tornadoes and storm chasing have likely heard references to rear-flank downdraft or RFD, a phenomenon that produces strong winds on the back side of a tornado. For that reason, it's an area that storm chasers usually try to avoid.

Tornado-genesis
"People thought that RFD was a crucial part of the tornado-genesis process, and it still may be," Finley said. "We've understood for a long time that the main spin of the supercell comes from the environmental wind shear, but nobody fully understands where the spin comes from that feeds the tornado."
Orf's pioneering work in computer modeling offers some promise in solving the problem, although he and Finley both admit they're a long way from a definitive answer.

The ability to compare Leigh Orf's supercell simulations side by side with storm chaser Hank Schyma's tornado videos from the field has helped the research group demonstrate the validity of the model.

"What this research is showing is that maybe we should be focusing more on the forward flank of the storm," Finley explained. "It could actually change our whole paradigm of the tornado-genesis process."

Before coming to UND in January, Finley studied tornado genesis at St. Louis University in Missouri. She intended to analyze the RFD on a computerized simulation based on an Oklahoma tornado when her graduate student asked, "What downdraft?" The simulation had produced a tornado with no RFD near the surface.

"We started questioning what was actually going on and ran several different scenarios," Finley recalled. "The nice thing about models is you can change things a little bit and see what effect it has."

The question the research group is now trying to answer is: what causes the air to spin faster at low levels where tornadoes form? Their theory is that a sudden drop in pressure is drawing in and concentrating the vorticity — the rotating wind — associated with the storm. This vorticity is then stretched by a strong low-level updraft that significantly speeds up rotation.

The group's model shows spinning vortices, sometimes invisible to the human eye, being drawn in to form what becomes the tornado funnel.

"The RFD may not be the cause of the tornado; it may be an effect," Finley said. "We have an alternate theory for the specific type of storm we're studying. We are arguing that it has more to do with the forward flank and the streamwise vorticity current (a spiraling inflow of air). It's the pressure drop."

Supercell simulations

Orf has spent a decade using his coding skills to modify a computer model to run on the Blue Waters Supercomputer at the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign. The model was originally developed by George Bryan at the National Center for Atmospheric Research. Finley did the groundwork and initial model simulations of the April 27, 2011, tornado in Tuscaloosa, Ala., one of the storms from the exceptionally destructive super outbreak of that week. Finley's work included finding a realistic and representative atmospheric sounding from the National Weather Service that would produce a tornado in the model.

For years, strong winds known as the "rear-flank downdraft" on the back side of tornadoes have been considered a sign of tornado genesis. New research suggests that rotating winds on the front side might be a better indicator of a forming tornado. Photo courtesy UND Aerospace Sciences.

In addition to the group's internal validation work, Orf has been working for the past two years with Hank Schyma, aka Pecos Hank, a Houston-based storm chaser with more than 20 years of experience. Schyma's high-quality videos of supercells and tornadoes enable Orf to directly compare his models with what Schyma has experienced in real life. They recently posted a YouTube video making side-by-side comparisons of their work.

"Honestly, it helps me understand whether the model is doing the right thing or not," Orf explained. "If it looks like a dead ringer for a real storm, then I know the model itself isn't creating some bizarre, unreal thing. It's what's really going on inside a storm."

Schyma remembered the first time he watched a video showing one of Orf's computer simulations.

"I was astonished by how accurate and beautiful they were," he said. "I thought they were Hollywood creations based on observations. I didn't realize that a supercomputer grew them, not a human. I'm learning a lot from watching these simulations."

Finley noted that what's not seen is the number of times the models don't produce the expected results from the data entered into them.

“We have failures all the time,” she admitted. But when a simulation parallels a real storm? “You start cheering and telling all your friends, ‘Look at this! Look at this!’ It’s really exciting.”
Although Schyma isn’t a scientist, he believes that Finley and Orf are on the right path to unlocking the secrets of supercells that form tornadoes.
“I’m ready to say this is an accurate proxy to Mother Nature, and we need more of these simulations,” Schyma said. “I think this is the most powerful tool that we have right now to help us understand these supercells.”

The early years

Finley grew up in Benson, Minn., where her father was one of the first spotters for the National Weather Service Sky Warn program. Always interested in weather and encouraged by her parents to pursue meteorology, she spotted her first tornado at the age of 12. She continues to chase storms, understanding that it’s important to see what happens in nature.
UND atmospheric scientist Catherine Finley was a founding member of the TWISTEX tornado chasing project. She is shown with mesonet instruments attached to a car used to collect weather data near tornadoes. Photo courtesy UND Atmospheric Sciences.
She also knows all too well the risks associated with storm chasing. On May 23, 2008, near Quinter, Kan., Finley and Lee were in a car equipped with instruments to take measurements as science directors of a tornado research program known as TWISTEX (Tactical Weather-Instrumented Sampling in/near Tornadoes Experiment). They thought they were in a safe location to observe a tornado, but within a minute, all that changed.
“That’s the only time I’ve been actually scared when we were out in the field,” she said. “We came very close to getting hit by the edge of the tornado.”
The tornado quickly grew to a mile wide and unexpectedly turned toward them. A 108-mile-per-hour wind gust blew the car off the road and into a ditch and toppled nearby power lines. There was no time to escape. On her office computer, Finley showed a video taken from a distance by another storm chaser. The edge of the tornado narrowly misses the car. Amazingly, Finley and Lee escaped without injury.
As founding members of TWISTEX, Finley and Lee knew project leader Tim Samaras well. His storm-chasing exploits and research have been featured on National Geographic and the Discovery Channel TV shows. On May 31, 2013, Samaras, his son Paul and chaser Carl Young lost their lives while chasing a tornado near El Reno, Okla. The largest tornado ever recorded made an unexpected turn.
“People in the El Reno event described the same thing that we experienced,” Finley noted. “They thought they were at a safe distance and, all of a sudden, it seemed like the tornado was right next to them.”
Eight were killed by the El Reno tornado, all of them in vehicles. But Finley knows that to better understand tornadoes — however dangerous the storms can be — she needs to chase them and observe them, as well as model them.
“To me, there’s something interesting and spiritual about it — just watching Mother Nature produce a storm and produce a tornado,” Finley said. “And every time you go out, you learn something, you see something interesting. Modeling is great, but you need to look at the real world to see if your models are looking like the real world looks.”

Dr. Lee is a Research Assistant Professor of Atmospheric Sciences at the University of North Dakota. His research experience spans a period of over 30 years, with severe local storms being a primary research interest. Tornado development and maintenance of both the supercell and nonsupercell varieties, supercell flow-field evolution, as well as supercell interactions with other cells, have been research emphases over Dr. Lee’s career.
He is currently part of a tornado research group (including collaborators from UND and the University of Wisconsin – Madison) that is attempting to further the understanding of tornado development and maintenance processes using very high-resolution simulations of tornadic supercells and supporting observations. Dr. Lee’s primary role in this endeavor is in the acquisition and analysis of corroborating observations, and in facilitating the application of numerical/observation research findings to operational nowcasting. Another related research interest involves the analysis of mobile mesonet data from within supercell hook echo and proximate regions, along with other supporting observations, to better understand the flow-field character and evolution that is critical to understanding tornado development, intensification and demise.
Dr. Lee was the director of the ANSWERS (Analysis of the Near-Surface Wind and Environment in Supercells) project in 2002 and 2003, and science director for TWISTEX (Tactical Weather-Instrumented Sampling in/near Tornadoes EXperiment, 2007-2011). In the “distant past” (1994) he organized a research team from the University of Illinois at Urbana-Champaign to participate in VORTEX (Verifications of the Origin of Rotation in Tornadoes Experiment).
Prior to joining UND in 2019, Dr. Lee was an associate professor of meteorology at the University of Northern Colorado, a senior atmospheric scientist at WindLogics, Inc., and owner/manager of High Impact Weather Research & Consulting, LLC. He has a PhD in Atmospheric Sciences from the University of Illinois at Urbana-Champaign (1995), a MS in Meteorology from the South Dakota

School of Mines & Technology (1990), and a BAEM (Bachelor of Aerospace Engineering and Mechanics) from the University of Minnesota (1982).
{NOTE from Hoyt: Before coming to UNC, Dr. Lee was forecast meteorologist for Republic Airlines. I also remember some MET students of those days coming back from an ill-advised personal vehicle chase of a thunderstorm with big hail out by Keota (Pawnee Buttes). After the hail bashed out the front *and* rear windows of the car they were in, they got out to seek shelter on the front porch of one of those old abandoned places in Keota. One of the students made it to the porch, but the other had been hit in the head and knocked silly. The other student retrieved him, revived him, and got him to the front porch. They are probably both lucky to be alive!}

Storm Chasing to Ph. D.

I'm not the best a coming up with humorous stories....but I would like to thank the UNC department of Earth Sciences for giving me the instruction, confidence, and nurturing environment that kept me going through to a PhD....coming to the UNC dept of Earth Sciences changed my life and I will always be appreciative.
The stories that are most vivid in my memory are the various field trips, going to a lake for your oceanography course, or doing field work with Dr. Finley and Lee with project ANSWERS (chasing tornadoes collecting data for this paper https://journals.ametsoc.org/doi/10.1175/MWR3288.1?mobileUi=0), and seeing in person during ANSWERS the Manchester South Dakota 2003 Tornado that was featured on the cover of National Geographic (https://www.nationalgeographic.com/environment/natural-disasters/chasing-tornadoes/

Erik Crosman, Ph D, Environmental Science Professor at West Texas A&M University, etcrosman@wtamu.edu

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The Barge (Photo on the Cover)

At the end of the 1980s, Hoyt got a grant to purchase a used surplus barge for use in aquatic studies on lakes and reservoirs; that was to enhance the oceanography program for those who could not afford to get to coral reefs or other ocean wonders far away! A surplus barge was found at Flaming Gorge Reservoir in Wyoming. But acquiring it was not in the cards: the federal surplus offices in Colorado and Wyoming were in the middle of what could best the described as a feud. So, I either had to give the money back or build a barge from scratch myself. Giving grant money back is not in my nature—it only happened once in the 40+ grants I've had in my career. It took 3+ years to complete the barge but involved several UNC heroes some of you know. The first hero was Ken Cochran, Ross Hall building technician who never found a challenge he wasn't willing to consider. I went to him with some ideas and calculations for the displacement (buoyancy lift) that would be necessary. Since I had a Sea Grant project at the University of Delaware to do a marine equivalent of such a barge (but with 10 times the budget and a great marine engineer and a great electrical engineer), I knew it was possible. The Coast Guard rules for flotation for such a craft require that even if the vessel leaks, it needs to still float. My solution was to use empty 55-gallon drums (14 of them), filled with Styrofoam packing peanuts. I The water-soluble corn starch peanuts would not do! Ken jumped in with both feet, and I hired a skilled fabricator (the second hero) to help with various aspects of the project (Walter Predovich, Secondary Earth Science major had fabricated Space Shuttle parts, and went on to a great teaching career in Pueblo. Walt always had several ways to solve a problem—he was such a gift). And in refits of the plywood deck in decades to come, I used high school students in the Frontiers of Science Institute summer program to replace the deck.

Meanwhile, I got a State of Colorado purchasing permit to go shopping at the Federal Surplus Yard next to I-25 in Denver. There I found amazing provisions to complete the barge:

1) Marine-grade 6061 T-6 hollow aluminum box beams (6"X6"X24 ft.), still in the band clamps from the factory;

2) Cadmium/stainless aircraft carrier deck bolts (8" length, originally $50 each that cost me just $.50 each)—boxes and boxes of them which could be used to attach the deck, frame and 55-gallon drums together in a solid sandwich ;
3) Waterproof Ammo Boxes and other storage boxes in various shapes and sizes to hold scientific and navigational equipment needed on the barge;
4) Stainless steel "chart, data, and equipment" table that had once been a medical/surgical table;
5) Various angle iron and wood from which I could fabricate cradles for the 55-gallon drums, and for use in construction of the trailer;
6) And various other marine hardware such as pulleys, cleats, and the like.

Later, I found people willing to donate everything from a large life vest box (from neighbor Robb Casseday), and hundreds of thousand Styrofoam packing peanuts from all over campus. For the barge trailer, I found a good pair of heavy-duty axles in Eaton, and the Aims Welding Technology class to build an amazing trailer to exacting specifications to launch and retrieve the barge (that trailer, probably worth close to $10K, cost me a whopping $200 in materials).

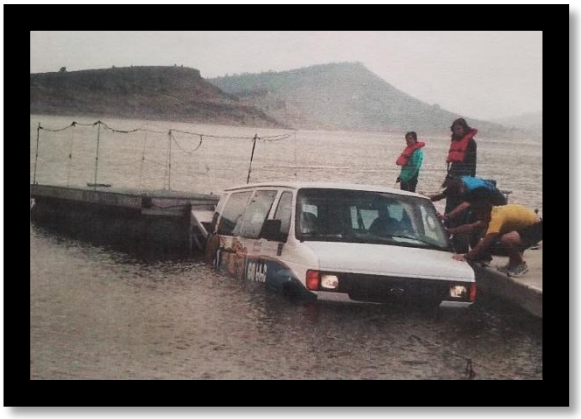
We constructed the barge next to the UNC Ropes Course and later at the Ross Hall parking lot. My oldest daughter Sarah is next to me and has her own daughter about that age now. It took me about a week to persuade parking services that it would be OK to finish the barge next to the building near power outlets and the Ross Hall fabrication shop. At the time, there was one person in Greeley who was skilled enough to weld the aluminum box beam together into a single frame 8 ft wide X 20 ft. long. The 8 ft. wide was chosen because that is the legal trailer or vehicle width (without being a "wide load"). That was Schofield's architectural welding. He used a giant forklift to get it from his shop on 16th St. up to UNC. The frame had a hatch amidships for coring operations. The frame was very strong. If you'd like to see some beauteous welds, head over to the UNC motor pool, where the barge is stored. The trailer is nicely engineered too and has similar good craftsmanship. No faulty welds allowed. That is only fitting for Weld County. Yes, I learned puns well from Dr. Hopkins! Sorry….

About the aluminum box beam, another story. One summer morning, Walter called me to say that there was some box beam missing, including two 24 ft.-long beams! The hunt was on to get it all back. The first call was to Anderson's salvage just east of Greeley. They had it, as well as the driver's license # and name of the guy who brought it in and collected the cash. And they had their own story: the thief and accomplice had opened the trunk of his heavy V-8 sedan and crammed in the ends of the 24 ft. long box beams. That left about 20 feet sticking out the back of the car and the front tires were barely on the pavement. The police arrested the guy, returned the money to Anderson's, and the box beams to us. Would have made a funny episode of a cop reality TV show where they try to make fun of criminals—*a la* "Home Alone"!

The barge was completed in 1992, certified by the Coast Guard, named, christened, and launched. The name just had to be the ***RV O. W. Tollefson****,* the research vessel named after the founder of our Department. Though Tolley had passed away, his two daughters (both teachers) were in the area and were happy to do the christening at Carter Lake on a cold and blustery November day. It was a day that reminded me of the song "The Wreck of the Edmund Fitzgerald" by Gordon Lightfoot. That was the iron ore freighter that went down in a November gale on Lake Superior. Not to be deterred by the horrible weather, the Tollefson Scandinavian stock smashed the plastic pop bottles on the hull and proceeded to accompany me on the maiden cruise. T'was not a fit day for man, woman, or beast, but there was nary a complaint from the wave-slapped faces of

the Tolley daughters! I'm sure their Dad taught them something about toughness, and the prohibition of whining…

Over the years from 1992-2019, I took about 1500 UNC students and a couple faculty out on the barge. Byron Straw and Joe Elkins may have their own stories because I took them a time or two each. I am sure students in my oceanography courses will remember the barge trip long after they have forgotten the name of the course or the professor! We took many people who were terrified of the water, and one brave student who was in a wheelchair! When the days after 9-11 rolled around, were tailed by Homeland Security officers in a 200-hp boat—just to make sure we didn't blow the dams and kill a bunch of people in a terrorist act. Several times over those years I offered to swap crafts—my 6 hp barge that went a max of 3 knots downhill with a tailwind for their fancy anti-terrorist craft that could tow about 10 water skiers. No takers. I was always amused by land-lubber Carter Lake Rangers who were super nervous about what we were doing out on the Lake in a homemade craft.

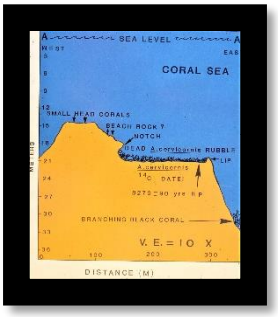


One of the more memorable trips to Carter Lake was not about anything that happened while we were out on the water. Rather it was while we were launching that I got the back half of the van "wet". Well, submerged is a more accurate term! Eventually we got things squared away and the rest of our operations were uneventful. But the motor pool called me after I told them what happened, and they informed me the insurance people declared the van a total loss. These vans are stripped down, with no carpets or other things that really would get damaged by a little fresh water. Nevertheless, they totaled it because the "electrical connections might rust". What (!!!), go to the saltwater coasts if you want to see rust! If I had been in the market for a 15-passenger van at the time, I would have bought it as a total loss—in a heartbeat. Somebody got a great deal, but not me. I had to fork over scarce Department cash to rewrap UNC logos on the next van. Oh, brother!

On that particular day, Belkasim Khameiss—one of my Libyan graduate students at the time--was on the trip. He made sure there was complete photo documentation of the incident. None of the 10 undergraduates on the trip took pictures, only Bel. How is it that graduate students always manage to "get" something on their advisors, whereas undergraduates rarely do? At any rate, Bel was quite amused at my error. I don't think he thought I was capable of such a mistake. Those who know him will recognize his toothy grin in their memory banks. There Bel, I got you back! In retrospect I could have gotten around the problem entirely by doing what I had done dozens of times before—pushing the barge part way off the trailer while high and dry on land. In my defense I was seething mad at the idiot Larimer park ranger who would not allow me to use the proper launch ramp that day. A good illustration of why you (I) should count to ten or take a couple of deep breaths when angry!

Sabbaticals

A critically valuable benefit for which faculty can apply are sabbatical leaves, where the University may pay some or all the salary while the faculty member does almost all research instead of almost all teaching. Most of the eligible ESCI/EAS faculty have applied for and been granted such leaves. Some have been denied, and other applications never quite got done—sometimes life and complications get in the way. Two that Hoyt took are examples of oceanographic sabbaticals: Great Barrier Reef Greenhouse Scenarios in 1989 (figure on



the left, 8700 year-old pickled beach-reef at 70 ft. depth now) and Chief Scientist with the Sea Education Association (Sea Semester tall ships sailing—figure on the right teaching aboard the *SSV Westward* out of Woods Hole) in 1998. Nesse got one for writing one of his textbooks, Shropshire got one on the geology of the Alps, Anderson got one for Pacific Rim teaching and volcanology research for Semester at Sea (cruise ship), Baird got one on Precambrian Rocks of the Front range and Adirondacks, Hackett got one with the National Research Council, and Shellito got one supported by the Fulbright program to help Ecuador with their in-country meteorology training and research. There were many, many others, but they are largely invisible to students of the time because the professors are not in the classroom. Professors come back raring to go with new ideas, fresh research findings, and scholarly networks that all improve teaching. I will say that even during dire financial times, UNC did try to continue to offer that benefit in some form or other. Since UNC faculty salaries have hovered near the bottom of our peer group for most of the University's existence, maintaining that benefit was very important.

A Reflection on My Time at The Earth and Atmospheric Sciences Department of UNC

Back in the Spring of '94, I made the rather significant life decision to relocate from eastern Pennsylvania to Greeley in order to pursue a master's degree in Earth Science. I had graduated the year before with a degree in environmental science but was struggling to land a full-time gig in my field. I had also recently lost my Mother and knew a change of scenery would be a good thing. Plus, moving to Colorado would allow me to pursue some of my passions such as skiing, hiking, and mountain biking.

Aside from a college friend who relocated just ahead of me to Ft. Collins, I had no Colorado connections. I saw it as a challenge and a way to force myself out of my comfort zone. I was thrilled when Dr. Shropshire called me in March 1994 to let me know I was accepted into the Department and to offer me a TA position. I accepted his offer over the phone that day.

Looking back some 25 years later, here are some of my fondest memories of my time at UNC…

· Making friendships for life – some wonderful friendships were born during my time at UNC with both follow students and faculty. In fact, Dr. Hoyt and I are both active in AIPG and run into each other often at the annual conferences.

· Guiding Geology 100 field trips to RMNP – imagine that, getting paid to take weekend field trips to Rocky Mountain National Park and talk about geology!

· The Colorado Geology field trip – during my first semester at UNC, Dr. Shropshire and Dr. Hoyt co-led a 5-day field trip around the northwest corner of the state as part of Colorado Geology. It was late September, the aspens were changing, and I was getting college credit for going on a camping trip. Times were good!

· The Permian Basin field trip – a spectacular trip as part of "Sed/Strat" class with Dr. Hoyt. to the Permian Basin and Carlsbad Caverns in New Mexico. More camping, hiking, and geology talks.

· Geo 100 lab section – with no former teaching experience, this was a bit of a challenge at first. With help and practice though, I picked it up and like to think I inspired at least several students to pursue a degree in Earth Sciences.

· Visiting "Star Lab" – a couple of my graduate student friends were TAs for Dr. Dietz's Astronomy class and I enjoyed visiting their evening sessions to learn about astronomy and view amazing sights through the telescope.

· Friday afternoon seminars– at first, I wasn't thrilled about a late afternoon class on a Friday, but soon realized that Earth Science Seminar was an excellent opportunity to learn from subject matter experts in a small intimate setting. The after-seminar social events at local watering holes were also rather enjoyable.

· Comprehensive exams – this probably sounds like an odd 'fond memory'. As soon as I set foot on campus, other graduate students told tales of the ever impending "comps". Of course, the thought of taking a written and then oral exam covering two full years of graduate-level courses was daunting. However, once completed, I was proud of the accomplishment of taking and passing the exams.

· Graduation – walking across the stage and being handed my diploma by Dr. Nesse, officially earning a master's degree, is one of the highlights of my life.
Dr. Hopkins, Dr. Shropshire, Dr. Hoyt, Dr. Nesse, Dr. Cobb, Rita Leafgren, and of course, Vicki, all made me feel right at home from the first time I set foot inside Ross Hall. As I reflect on my time there, I can only recall good memories and kind, friendly people. Thank you to everyone who made our time as students an outstanding life experience.

-Cheers!
Joe Kraycik, Class of 1996, M. A.

UNC Reflections

This week/month/year marks 25 years since my meteorology "family" and I sat in the warm sun on the old Butler-Hancock Field and graduated with our Earth Science: Meteorology degrees. As we celebrate 50 years of Earth Sciences at UNC, I'm feeling old knowing I've been associated with the program for over half that time! I'm still in touch with many of my college "family" and one student actually introduced me to my husband about 2 months after graduation, and then later married my husband's cousin. Our kids are now second cousins!
While at UNC, the internet made its debut (~1992-93). We taught each other the Unix commands we needed to chat with each other, and the ones to see if our friends were online in another part of the campus (you had to "finger" them!). And, we'd check our emails to one another on the "Blue" server. To think, there was a time I thought email was fun, ha ha ha! I recall my freshman year, wondering if I'd ever fill up my one 3.5" floppy disc with the few papers I typed up on a borrowed word processor. But, when we started learning to FTP to get satellite images, I had to go spend money to buy an ENTIRE box of ten 3.5" floppy discs! I also remember in 1994 when we got the first Pentium 5 computer on the third floor of Ross Hall, it was hidden away in a small meeting room east of the elevators, and it was where we could do training modules from COMET on laser disk. The computer lab nearby only had 386 and 486 processors, so it was nearly a race to get to the third floor first each day to use the P5 instead.

My main memories of UNC are the 3rd floor of Ross Hall, with Dr. Cobb acting as our holistic medicine man since many of us couldn't afford medical care (I still take bee pollen for allergies!) and Dr. Erasmus teaching us that real crystal wine glasses could "sing" if you used a wet finger and ran it around the rim of the glass quickly over and over (his opera singing wife could hit the right frequency to shatter a glass!). I recall when Dr. Cobb pulled me aside and told me he named one of his baby goats after me, and then he had to name the rest of the baby goats that spring after many of the others in our group. He and his wife Marta invited us into his home to make apple pie from scratch, something many of us greatly appreciated. I recall him asking us one day, "Give me some weather and climate myths, quick!" Apparently the Greeley Tribune called and wanted to do an interview with him, and he needed us to help him make up some weather myths before his call that afternoon. He did share one bit of folklore with us all on the first day of MET 205: ***"Mackerel scales and mare's tails make lofty ships carry low sails."***

Thanks to Dr. Cobb, who believed in me when I didn't even fully believe in myself, I was able to do a student internship with the National Weather Service in Cheyenne, WY my senior year. At least five of us in my time at UNC had that invaluable opportunity.
Dr. Erasmus even allowed me to take my climatology class remotely while I worked/lived in Cheyenne. When I showed up for the final at the end of the semester, some of the younger students in the room looked at me strangely. One asked who I was, and I replied, "I'm a senior, I didn't have to come to class." That got me a strange look, but seniority had its privileges to tease the underclassmen a bit!!
We were able to start the Delta Chapter of the National Weather Association in late 1993/early 1994, the idea of Scott Longmore before he graduated. Chris Jones and I served as the President/Vice President of it our senior year of 94-95, and also co-shared those duties with the Southeast Wyoming American Meteorological Society Chapter.
It's been an amazing career and I am so very appreciative of all the opportunities UNC provided. From organizing a conference with our meteorology chapters, CSU and NOAA employees, to visiting the CHILL Radar and going to various professional society meetings

and learning from experts in the field of meteorology, it was a great place to build roots for a long career. I appreciated the smaller sized campus, and access to NWS offices, NOAA and NCAR, TV meteorologists in Denver, etc.
I do want to mention a friend of ours from the meteorology program who passed away just before Christmas our senior year. Rick Minor was from California and losing one of us was a pivotal point in our young lives. His father called me to break the news, and I was the one who had to call our friends, and Dr. Cobb. He was as shocked and saddened as we all were. All the professors on the 3rd floor, from math, to computer science to the Earth Science program were great in helping us when we returned for the spring semester a few weeks later. Our group of friends came together in a way that bonded us for life.

Tanja (Henson) Fransen, Class of 1995, Earth Science: Meteorology; Award-Winning National Oceanic and Atmospheric Forecaster and Communicator

All things considered, the decade of the 1990s was a very good decade as we settled into the semester system and avoided major drama. But financial storms continued to threaten the Department, and little did we know that a major reorganization of the University and the Department structure would happen after the turn of the century. We started to plan for a major renovation, addition, and modernization of Ross Hall. That was some of the most fun we have ever had at UNC!

The 2000s: Department to Schools and back to Department

A Renovated and New Ross Hall

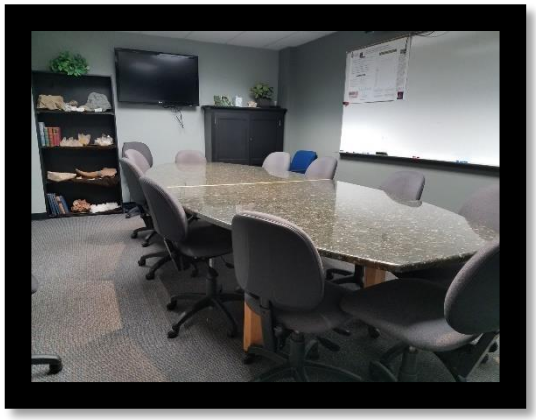
Through the late 1990s and early 2000s UNC acquired some capital money to get faculty offices out of the basement of the library (where ventilation was designed for books, not humans). At the same time, all other academic buildings were bursting at the seams, especially in the sciences. There was an authorization to plan a $41 million revamp and new construction of Ross Hall of Science, which had originally been constructed in 1964. Those of you who habituated the old building will recall how spartan it was. I took over Shrop's basement office next to the building heat exchanger when he moved upstairs. That office, especially in the summer (before the building had air conditioning) was as close to hell as I have been.

I believe the planning, design-development, arm-wrestling, and value engineering took about 4 years to complete for the new and renovated sections of the building. Dr. David Pringle, Professor of Chemistry, was tapped to be building "shepherd"; his job was to attend to every detail with every department, haggle with the architects and construction contractors, and generally make sure there were few screw-ups. Additional departments that would now be housed in Ross Hall included English and History (among some other offices). Those were two of the larger departments in the University. It was a colossal undertaking that spanned the Chair terms of both Nesse and Hoyt. Earth Sciences would remain on the top floor of Ross, taking over the entire east end of the old 3rd floor and adding three new-construction labs built over the old east parking lot. No longer could we watch the sub-basement seismometer (below the Physics Office) show the flexure of the east end of the building go up and down each weekend as the cars came Mon-Fri and went away Sat and Sun. We maintained a basement field equipment and storage room next to the loading dock, but overall did not gain much space. All the offices and research labs and teaching labs and classrooms were contiguous. That was a great improvement over the Department's history of having closets, cubbyholes, storage rooms, and faculty offices all over the building! During the year we had to vacate the building, we shared office space with Chemistry & Biochemistry in the new part of Ross (which was completed first). Physics spent the year in the old Lab School, which had become pretty quiet since K-12 students had moved out a decade earlier.

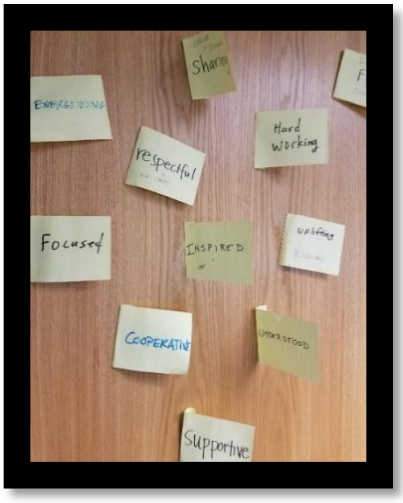
The Conference Room Table, Fight to Paint the Walls, and the Marine Fish Tank

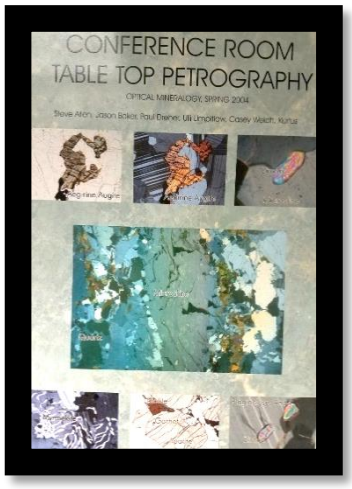
We have a Conference Room in the new building, what about a special ESCI table? No, you can't do that because all State agencies are required to purchase all furniture from Correctional Industries/Juniper Valley. That's right, the prison system sold furniture to all the State agencies—at about twice the price of what we could get it for from the big box stores! Classic case of robbing Peter to pay Paul. Was that the final answer? Not quite—we could apply for an exemption. We were to send in the specs for the table we needed to them, and if they could not do it, we could get permission to purchase it elsewhere: we needed a 3 cm-thick natural stone table, with a half bull-nose edge finish, 5th order ellipse on both ends, with a solid oak base. Well, we probably had them at "natural stone table", but Nesse had the idea to throw in "5th order ellipse" to seal the deal. I suspect they took one look at the specs and said, "go get it elsewhere"! I think I have emphasized how important it is to be able to solve problems several different ways. Another lesson from Nesse!

Fortunately, we had a graduate student at the time, Tom Sharp, of Shepherd and Sharp Stone in Ft. Collins. He got us two beautiful slabs of "Verde Butterfly Granite" from the Minas Gerias mining district of Brazil. That is our sister "state" in Brazil through the "Partners of the Americas" program championed by Rhoda Rogers, Binka LeBreton, and Betty Brown. It is special to have something in our Department from Minas Gerias. Back



to the stone Table…. The twin planes of the feldspars gave it a green butterfly-wing-look, and the maroon-colored garnets could not be missed. Nesse fabricated the solid oak base and we had 4 burly moving crew guys bring up the two slabs in the freight elevator—one at a time. That Precambrian granite will outlast the building. The conference table and the room is the most attractive in the University. I have told UNC people my opinion about that for more than 15 years and have yet to be challenged on the claim. We have had a lot of extra visitors that know us and what we do, only because of that conference room! We got a clear acrylic finish for the table that is very close to being bullet-proof. I think every faculty member and every small seminar class would like to meet in there; it is used a lot! It has become a favorite place for College or University groups to come set up a small conference or discussion. We showed off the new building and had a reception in that conference room for alumni. If you missed it, and the free wine and cheese, come back and I will give you a personal tour (and a beer). And on the back of the conference room door are faculty reasons identifying why they like to come to work in the Department (picture to right). They are just post-it notes, but they describe what fun it has been to work in Earth and Atmospheric Sciences over the decades. We assembled that list after some dysfunctional years due to Charting the Future. Much of that misadventure played out in the next decade…





Nesse wasted no time getting the mineralogy and optical mineralogy students to study the heck out of some extra slabs of the Verde Butterfly Granite. There are many photo micrographs of thin sections (0.3 mm thick) that are on the walls of the conference room (photo to left). In addition, there are displays of cool fossils and other things around that let you know immediately that you are a valued person just by being there!

To match the green/grey hues of the granite, we needed to paint the walls something other than institutional white. The contrast of the table with the institutional white might cause several somebodys to get sick to their stomachs! Again, institutional white was *required*—final answer! Enter superhero Vicki Ouellette. She chipped away at that answer for the better part of a year until the paint shop relented—allowing us to get a custom color paint from the paint shop if we would paint the areas ourselves. Vicki also painted the office area a similar hue, which tied in nicely with the marine fish tank that shortly was to follow.

A couple of my oceanography students were interested in marine aquariums, with lots of coral and tropical fish. In conjunction with Animal Attraction on 11th Ave we started on the project. It would not have happened without Vicki's enthusiastic support. The two guys (Chad Lane and Jake Miller) wrote a grant to the Student Representative Council for the cost of the project. They fabricated the aquarium top

and grow light chambers, and we were off and running on another aesthetic—and instructional—amenity that made the office a popular drop-in place for young and old alike. One of our frequent visitors was the Chair of History, Barry Rothaus from just down the hall. Though I am sure he liked the tank, I think he liked Vicki's candy dish full of chocolate and loved talking to the ever-entertaining Vicki. Over the years since the tank started, we have hired students to take care of it, replaced hard corals with soft corals, and purchased new fish as the old ones went the way of all fish.

Many of my classes, Rita's classes, and Byron's classes (maybe others?) have used the various species in the tank for observation studies, directed studies research, and as a springboard to jobs or marine aquaria of their own. One guy that was particularly interested was a business major who started his own aquarium business in Highlands Ranch.

{NOTE: The story below is about Jared Morrow, paleontologist and sedimentary geologist who replaced Lee Shropshire. It indicates the kind of people the UNC Earth Science Department is fortunate to have on its faculty. It also hurts to remember Jared's life cut so short.}

Alumni Joe El Adli honors his undergraduate advisor Jared Morrow by naming the discovery of a new species of the extinct baleen whale after him, *Herpetocetus morrowi*, 28 January 2014, by Tony Carrasco

Alumni Joe El Adli has published his research on fossil baleen whales that he started with his undergraduate thesis done here in the department {at San Diego State, where Jared went after UNC} and at the San Diego Natural History Museum. In a major portion of the manuscript, he described a new species of whale, which he named after his co-advisor Jared Morrow. Faculty, friend and colleague Jared Morrow lost his battle with cancer on Oct. 7, 2010.

ACKNOWLEDGEMENTS (from an article Adli published)

The authors would like to recognize the life and accomplishments of Jared R. Morrow for his contributions to sedimentary geology and for his tireless efforts to educate a new generation of geologists and palaeontologists. Jared's endeavours to help his students in any way possible did not go unnoticed or unappreciated. He is greatly missed. …..

Artistic reconstruction of Herpetocetus morrowi sp. nov. in the late Pliocene Pacific Ocean off southern California.

"So, When Were You Going to Change Your Major?"

Let me first start by saying that I wouldn't be where I am today if I hadn't walked through the doors of the Earth Sciences Department at UNC. Until that point, I had been aimlessly searching for what I was "meant" to do, and not finding joy in any of my options. I started my college career at CSU as a Mechanical Engineering major, which I quickly decided against after viewing the required courses in mathematics. After deciding I didn't want to be known only by my student number anymore (rather than by my actual name), I transferred to UNC mid-way through my Freshman year of undergrad. I had decided to major in Elementary Education with an emphasis in English, of all things. This seemed fine for a semester, and I found some semblance of a rhythm. However, when I was asked to join an English Honors Society where the initiation ritual involved black robes and candles . . . I realized I was in the WRONG place. I needed more down to earth people . . .

Luckily, that first semester at UNC, I was fortunate enough to take Rita Leafgren's Earth Sciences for Elementary Teachers class, and I found myself more fascinated by that class material than any I had taken so far. I found a kindred spirit in Rita, and we struck up a friendship. I would often stop by her office just to chat. I felt at home in the Earth Sciences Department, and it drew me back day after day. One fateful day, a couple of weeks into the first semester of my Sophomore year, Rita finally looked at me and said, "So when were you going to change your major?"

It turns out that little prod woke me up. That one little question was all I needed to change the course of my life. I promptly switched my major to General Earth Sciences two weeks into the semester, and believe you me, it was not easy to convince Dr. Dietz to let me in his astronomy class. He squinted at me over the top of his glasses, skeptically assessing my enthusiasm and silently debating whether I would catch up. He finally agreed, and I took it as a challenge. And, Dr. Dietz took on the challenge of breaking my bad habit of using flowery language learned from years of English essay training in my Astronomy project reports. I've never seen that much red pen on one document in my life as I did on that first report I got back. I can just imagine him rolling his eyes every time he had to grade my papers the rest of the semester.

I'd like to mention that Rita's brilliant guidance didn't stop merely at changing my major, she also suggested that I ask Dr. Jared Morrow to be my advisor. I don't think a single other act could have changed my life more profoundly. His guidance and sincere concern for my academic career were clearly his Number One Priority as it was with all his students. Through my classes with the department, I finally found that Geology was my true calling. After that, Dr. Morrow introduced me to impact craters, and Dr. Nesse introduced me to the XRD. The rest is history . . . except for the fact that I had to be "blessed" to use the new XRD machine, which included a safety video with a warning about fingers turning black and falling off in the extremely unlikely scenario that you stuck your hand in the machine while it was running.

There was no doubt about it. The research bug had bitten me, and I couldn't wait to learn more. I eventually went on to study carbonate target impact craters for my Master's Degree with Dr. Morrow at SDSU, and somehow, found myself in the oil industry. I am now a subsurface manager for BHP's Infrastructure-Led Exploration (ILX) team, looking to add value by bringing nearby overlooked oil accumulations to existing platforms. I wish that I could still chat with Jared and ask his opinion these days. I valued his input and insight more than anything and will always miss him.

I want to thank everyone at UNC that can't fit into a short essay, as I have fond memories of everyone, but here are a few honorable mentions I'd like to add.

Vicki Ouellette – Thank you for your kindness and for giving me a chance to work with you in the department.

Dr. Hoyt – I'll never forget the trips to gather plankton from the pontoon boat – the students were always so excited to return to shore that we'd scooch to the front of the boat and lift the engine out of the water in the back. {Editorial note: that should be bow and stern}.

Dr. Nesse – Thank you for asking us to describe minerals, which we would do over our lunch hours, eating food and finding out that we were handling Orpiment and Realgar, getting our Arsenic allotment with our lunch. Oh, and thanks for allowing me to be trusted with the brand new XRD.

Dr. Hopkins – Thank you for making sure I never forget what a Tuya is.

Dr. Morrow – You changed my life. I can't thank you enough.

Rita Leafgren – Thank you for pointing me in the right direction.

-**Kean Bliss (Lewis),** BS, MS; undergrad major path: mechanical engineering, elementary education (English concentration), general earth sciences, and finally….geology!!!!

Meteorology on the Move

After the renovation of Ross Hall and the new digs for the meteorology lab, Dr. Nutter and Dr. Shellito continued the modernization of the MET curriculum and the lab that Drs. Erasmus, Finley, and Lee began.

Some students had the idea to apply for UNC technology money (more than $10,000) to install a state-of-the-art forecasting lab with 4 data sets that could be combined to formulate a central forecast in the lab. Gone forever were the old pegboards! There is also a hallway monitor that plays interesting recent weather events for passersby. Big grants from UNIDATA written by Dr. Nutter netted the Department about 20 dual-boot LINUX/Windows computers to allow digital analysis, visualizations, and computer modeling of the new millennium.

After the 2008 Windsor Tornado, FEMA funded an education program for Windsor School children that Dr. Nutter and the MET students carried out in the local schools. That included a tornado simulator model that they constructed and has been used many years hence. Many thousands of school children have brazenly stuck their heads into the simulator…much to the chagrin of their more cautious teachers and parents!

The 2010s: Professional Science Masters & the End of Lawyers

The UNC Lawyer Presidents

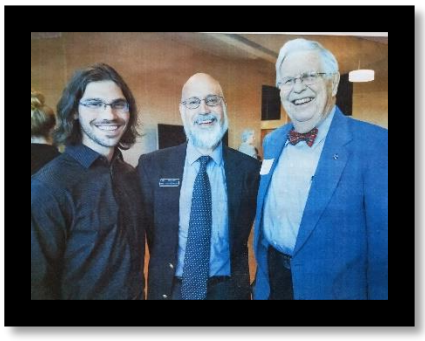
After the departure of UNC president Herman Lujan (under unfortunate circumstances), interim president Howard Skinner did a great job re-assembling a somewhat unhappy faculty. Dr. Skinner was conductor of the Greeley Philharmonic, and a revered UNC music faculty member. Howard would regularly go on long runs so that he could conduct the Philharmonic and his chorale groups with maximum energy and stamina. I loved singing under Howard's direction with the Men's Glee Club. Howard conducted the oldest philharmonic orchestra west of the Mississippi, so he had a long tradition to keep up! He took his duties as interim president at UNC with similar resolve and gusto. He is the only faculty member or president I recall driving a Cadillac and wearing a tuxedo a lot. The only time I wore a tux in Greeley was when I did concerts with the Men's Glee Club with Howard as conductor. Well, I did wear it to serve some home-cooked cuisine for my wife a time or two.

As there were many financial woes pressing on the UNC Trustees, they choose to do a direct appointment of Hank Brown as the new president. I don't recall any faculty involved in that hire since the choice was taken out of the hands of the search committee. Hank was a Greeley guy who rose to a senate seat in Washington, DC from Colorado. He had a law degree, and a naturally smooth demeanor that allowed him to work effectively across the aisle in the senate. Though a conservative republican, Hank co-sponsored the wild and scenic rivers act, declaring the Poudre River to be among the first on that list. He also was a champion for clean water and clean air initiatives and supported establishment or expansion of national parks and monuments that we used so much. I considered him to be a great friend of the Department, and a wonderful president.

Though many faculty were suspicious of how a lawyer might run the University, others quickly realized that he could pull some strings and get things done like nobody's business. All the cuts he implemented were hard but in retrospect they were needed in order to replace funding the State of Colorado was removing increasingly from UNC's operations each year. The reason that is significant for you alumni from those days is this: Hank's budget-trimming allowed student tuition to remain relatively low. Under the next president's term and Colorado's continued abdication of public higher education funding, student tuition would steeply rise in the following years. When push comes to shove, states generally fund prisons instead of funding colleges that typically *prevent* people from ever going to prison. That's the topic of another book—that I am not qualified to write! I will point out that many if not most Ph D and CEO jobs in Colorado are filled by people educated in other states. Think about that….and what it means for the future of Colorado. Our Department faculty are no exception to that trend.

The two big severances that "left" the campus as "non-essential" during the Hank Brown years were KUNC Radio and the University Lab School. The PBS station had been operating out of Carter Hall with several UNC employees for decades. It was a great community service and an award-winning radio station—but was severable without destroying the University. Now KUNC is off-campus and is generally thriving. A music-only spin-off called "The Colorado Sound" is also doing well. The much bigger ticket removal was the 111-year old Lab School. The College of Education considered it essential, but it was clear that surrounding school districts and other partners could fill that role to some degree. A new, and much larger campus for the "University Schools" was constructed in west Greeley, thanks in large part to philanthropist alumni and Roche Constructors. UNC lost some important faculty in that severance, chief among them Ray Tschillard. However,

years later Ray came back to Greeley, taught several graduate courses for us, and now directs the wildly successful Poudre Learning Center. Ray has also been on the College Advisory Board representing our Department, advocating with his "never say no" style. Like many of our alumni, Ray has made a critically important contribution to this community—and other alumni have done the same in their communities.



After Hank left to do other things (like being the CU president and leading the Boettcher Scholar program), UNC was again in the hunt for a new president. The UNC Trustees had such a good feeling about what Hank was able to accomplish, they saw their way clear to direct appoint another lawyer: UNC Legal Counsel and Board of Trustees Secretary Kay Norton. The faculty were more than suspicious this time. But in the middle of the tomfoolery, we still had fun. The photograph to the left is a three-generation picture with UNC president Dick Bond on the right, me in the middle, and Dr. David Lerach on the left. Dr. Bond hired me, and as a biologist had a special appreciation for oceanography. After he retired from UNC in 1981, he ran for State Representative, won handily as a Democrat in Weld County, and used his signature bowtie as his campaign icon. Dick also has been very active in the area, doing everything from starting charter schools to serving on the Poudre Learning Center Board of Directors for years.

Charting the Future

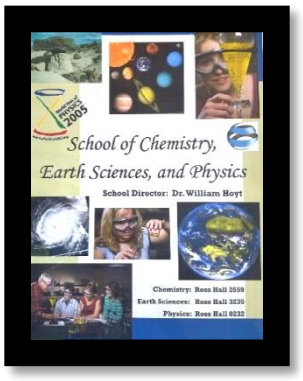
Kay Norton initiated a strategic planning process called "Charting the Future" in the mid-2000s. There was at least one initial blunder in setting up the secretive Design Team: there were no faculty on the team, and nobody on the team had a Ph D. No one on the team was permitted to say specifically what was going on, a strange approach in a University built on communication, dialog, and educational discourse. There was one Dean with an Ed D as a team member, but that was not very representative in deciding the whole University's future. After about a year of comprehensive reports from every department and unit, President Norton announced that there would be some shuffling of units to form some new colleges (thereby breaking up the giant College of Arts and Sciences). Though big structural changes are hard, most faculty agreed that it at least made some sense to reorganize Colleges in the University structure. But for you alumni, College names and reorganizations were largely meaningless anyway: you have your allegiance to your Department. Right? RIGHT! Well, Angel Enriques worked in the Dean's office, so I will allow him to have devotion to both.

What many faculty and departments strongly objected to in the 2005 Charting the Future implementation was the requirement that many departments were forced to join together in large, unwieldly and sometimes bizarre new Schools. Those Schools were to have a single Director and no Chairs of the units anymore. Kay's idea was that a year-round skilled Director (not a person with faculty status) could more efficiently manage the workers. It was more of a factory-industrial model. Generally, people with Ph Ds don't see themselves as the "little people" on the factory floor. A previous president who shall not be named let that "little people" term slip one day in reference to UNC staff members. Not the stuff of good leadership.

The medium-sized or small-sized departments were the only ones subjected to this radical change. The large departments or schools that previously existed stayed as they were before, except that chairs were now called directors. In our case, we became the School of Chemistry, Earth Sciences, and Physics (CEP). We sounded like a small community college unit, but we had over 70 contracted Ph Ds, staff, and teaching assistants. We were spread over three floors in two far-apart sections of the newly constructed Ross Hall. We had 10s of thousands of square feet with large equipment and materials stores scattered across dozens of labs, research

facilities, and classrooms. All those previously-spent $41 million were designed around departmental structures, not large centralized schools. We thought we were dying and going to hell. Many pointed out that the US Army had captains over 10 people, not 72. Did they know something the Design Team did not about getting jobs done well and most efficiently? I think Shropshire and Nesse both had been in the military and were not shy about expressing their displeasure. Nesse opined that those on the Design Team had "not clothed themselves in glory".

What made matters worse was the fact that nobody in their right mind would take such a Director job for the School of CEP—and UNC had no intention of hiring someone from the outside to do that (think very big bucks). They required us to convert a faculty person to Director overnight. Call me insane—and slow. I did not step back fast enough, and found myself as Director of a School structure I could not be happy with… I took one for the team, but I was clearly unhappy. The former Department chairs of Physics and Chemistry and Biochemistry sat in the chair offices, and in virtually every way did the work of the former chairs—except they were called "program managers". That was a big demotion, without the previous status or Chair stipend. They did get some reduction of teaching duties so they could do the class scheduling, budgeting, equipment and materials ordering, hiring teaching assistants, faculty, staff, and student workers, and the like. For me, it meant that I had to run to sign forms a few times per day in Physics (round trip six flights of stairs) and Chemistry & Biochemistry (four flights of stairs and in the other building).



To be fair, I did get many more steps and flights of exercise in those years, and I did like getting to know all the faculty and staff in those units much better. And for the former chairs of Physics and Chemistry & Biochemistry, they did not have to go to those interminable leadership team meetings and spend many hours each week designing and managing many aspects of a brand new college with a new dean. In a way, it was fun to create something out of two separate Colleges that were a half-mile apart—trying things that had not been done before. But many of those benefits we were already doing with our health science colleagues before Charting the Future.

Simultaneously we formed a new College of Natural and Health Sciences, with a new Dean (Denise Battles). I did my best to countenance the new job, but after two rocky years watching people "drowning on the waterfront" the Dean and I agreed that I needed to resign. My views of how things should be didn't match well with the administration's view. We were the only school in the new college that was unhappy with the structure. The other units saw a much more seamless transition with Charting the Future. And I made mistakes as Director at a rate I had never before (or after) in my career. That is one of the sad side effects of dysfunction that I seethed in every day. Again, these are things students never saw and that's a good thing.

After I resigned, the School of CEP could not agree on a replacement Director from the faculty—as I recall, there was only one person interested. Again, hiring someone from the outside was out of the question, both because it would cost a huge amount to fill such a job, compared to almost free for just "converting" an existing faculty member to the new director purpose. The School of CEP was dead in the water, without a skipper. The Dean came back to me and asked me to serve out the third year of my Director appointment. I was willing to do so under one condition—that the Dean work with me to break up the School of CEP. Step one in getting back to a functional structure was to split off Chemistry & Biochemistry as a Department again. It was the first domino to fall in the line of ill-conceived "Schools of Whatever". Earth Sciences and Physics remained as a School of ESP—still a poor idea, but better than CEP. At least we had extrasensory perception now as a super-power status?! Now I only did half the running around that I had done the previous two years.

I made up for it by joining the UNC/Bell's running club that met for a great workout Wednesday evening at Nottingham Field track.

The next year, the Chair of Physics, Dr. Cynthia Galovich, rescued me from the Director job for three years. Bless her soul! She and Dr. Nutter nominated me for UNC's top faculty recognition the year after that, the Lucile M. Harrison Award. I took my family to Hawaii one summer with the money I was given for that honor. The speech I gave at UNC Convocation in the fall of 2010 emphasized that it takes about 10,000 hours to get really proficient at a craft (that is Malcolm Gladwell's assertion). I encouraged the freshman class that by that measure they should be proficient at being students by now! I also turned the UNC Bear Profile upside down to emphasize the value of looking at things from different perspectives. Upside down it was much easier to recognize that the UNC logo was actually a shrimp. A perversion of the logo that PLR Director pointed out that only an oceanographer could see. A few years later Ken McConnelogue and the UNC brass decided to change the UNC logo to a full-frontal snarling bear face, and later to the smiley bear we currently enjoy. I think it is better all-around for many reasons.

Back at Ross Hall, we continued to work on getting back to the Departments of Earth Sciences and Physics but doing so in a "cost neutral" way was an insurmountable challenge for some. It took a change of Deans, a few more years, a change of rules, and the administration's recognition that there was no benefit to keeping the School of ESP going. Talk about a title that did not represent the sciences of Physics, Astronomy, and Earth Sciences! Astrology, maybe! After 8 years of administrative struggle and a considerable amount of time and effort, we were back to the Department of Earth and Atmospheric Sciences in 2013. Physics became the Department of Physics and Astronomy. I guess I am only a little resentful that I wasted so much of my life during those 8 years undoing something that was ill-conceived in the first place. To her credit, toward the end of Kay Norton's 14-year tenure as University president, she publicly apologized for the damage and angst caused by Charting the Future. The bad parts of it mostly affected us in Ross Hall. We finally got out of purgatory! Many of us got singed by the flames, however.

Like a Phoenix rising out of the ashes, the Department had some of its happiest years under the next Dean of the College of Natural and Health Sciences: Dr. Ellen Gregg. She did a fabulous job as you may glean from her fond remembrances of the Department.

Stories of a Great Department

My first encounter with a faculty member from the Department of Earth and Atmospheric Sciences came early in my career at UNC. I was fortunate to serve with Dr. Bill Hoyt on the university-wide Honors Committee chaired by Dr. Ron Edgerton (History) during the late 1980's and early 1990's. Bill was a vital member of this committee who epitomized engagement in the life of the mind. While he clearly had an extraordinary depth of knowledge in his own discipline, his curiosity about connections among disciplines and his dedication to exploring ways to stimulate students' curiosity and learning inspired me.

Bill also led me on my first geological field experience with other members of the Honor's Program faculty at Old Man Mountain exploring a cave on the property. This didn't turn out quite as any of us expected. I developed claustrophobia in a very narrow section of the cave and turned around on my own only to get lost finding the exit. I ended up outside the cave far from our starting point and not sure how to return to the parking area. Joe, my husband, and Bill led the search party that eventually found me perched on a rock high above the cave. I think that experience illustrates the relationship Bill and I had through the rest of our time together at UNC – he would encourage me to try new experiences or see things from new perspectives. Importantly, he was always there to help me successfully navigate the paths that led from those.

It was not until 2012 when I stepped into the role of Interim Dean for the College of Natural and Health Sciences that I had the opportunity to become more broadly familiar with the faculty and staff

in the Department of Earth and Atmospheric Sciences. Vicki Ouellette, department's administrative assistant, welcomed students, faculty, and visitors with knowledge, caring, and candy (always!!). In the faculty I discovered a remarkable, passionate, and diverse group of teacher-scholars. Whether in the classroom, lab, or field they prioritized energizing students to explore the earth, oceans, and skies round them and seek understanding of interconnections among them. Faculty meetings (around the best conference table at UNC) were filled with support for one another, challenging discussions, humorous interludes, and dedication to students and the institution.

In closing, I want to express my appreciation of those with whom I had the good fortune to serve – Steve Anderson, Graham Baird, Sharon Bywater-Reyes, Joe Elkins, Emmett Evanoff, Wendi Flynn (photo above), Steve Good, Bill Hoyt, Rita Leafgren, David Lerach, Cindy Shellito, Byron Straw and Vicky Ouellette. I was indeed fortunate to have you as colleagues!

Ellen Meyer Gregg, Ph. D., Dean Emerita, College of Natural and Health Sciences; Professor Emerita, Speech-Language Pathology

During a 2018 graduation ceremony, Dean Ellen Gregg (center) poses with (L. to R.) Drs. David Lerach, Cindy Shellito, Graham Baird, and Sharon Bywater-Reyes. The mere fact that she stood for this picture with Department faculty speaks volumes! On the occasion of Dean Gregg's retirement party in the Dean's Office, a long-standing joke became reality—a margarita machine in the Deans Office to assuage the painful news we might hear there! That was actually a rare thing to hear in the many years during which Ellen served as Dean.

Meteorologists Migrate

Students in our Department did not see any of that. What students did see and reacted strongly to was the premature departure of beloved faculty at the hands of a dean. Students often come to our Department because they meet our faculty and immediately feel a part of the family. And when one of the matriarchs or patriarchs of the family leaves, they can vote with their feet. One faculty member who was a top meteorological researcher received a top research rating from the faculty, which was downgraded and overturned by the dean. It did not change the overall rating of the faculty member, but the damage had been done. The faculty member was so troubled and offended by the affront that greener pastures started showing up in the distance….. What made it particularly reprehensible was the fact that the dean at the time was an English professor with little understanding of scientific research processes or prowess. Sad to say, that was not the only run-in with that dean. Pride may be one of the seven deadly sins, but it is not the only one that can trip people up and make their lives miserable.

A decade later with a different dean, a faculty member got crosswise with the dean, and things gradually devolved from there. Neither the dean nor the faculty member had "conciliatory" in their first repertoire, and after a couple years of trying and several skirmishes, I was unable to change the damaging course of events. The faculty member resigned in the face of not getting tenure (and thereby being forced to leave). Of course, that faculty member has had a very successful career elsewhere and is a good friend to the Department to this

day. Another sudden drop in enrollment ensued because students felt that a beloved faculty member was mistreated. They voted with their feet again.

What Else Is There Besides Content Knowledge?

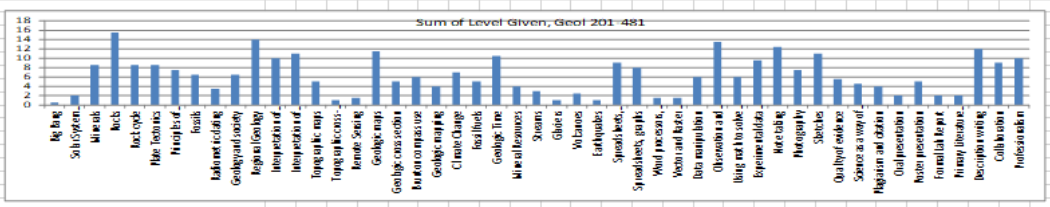
One of the strong themes of the last decade of the Department's history has been trying to figure out what our students know and are able to do *not only* in the domain of content skills *but also* in the domain of professional skills. We have always given grades for course work that largely focuses on the former. But employers and managers would also like to see that universities are preparing students in the areas of professionalism and professional skills. And seeing in our graduates the desire to be more than they were when they were hired as new employees. Ambition is close but not quite right. Perhaps the best way to describe this need is by relating the comments of two geology majors who came back to meet with us 25 years after they graduated from our department.

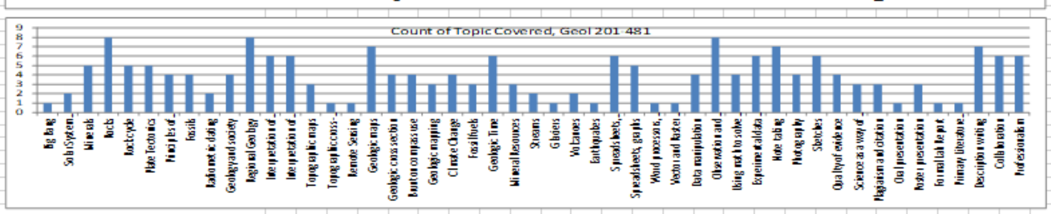
Chip Devalt and Dave Nicholson buddied around together when they were geology majors in the mid-1980s. Everybody had nicknames for the pair. They made an appointment to meet with me and some geology faculty all those years later, still best friends (about 2013); they said they wanted to catch up and tell us how their businesses were going. Part way through the discussion Dave asked a profound question: "Why did it take me 25 years to become CEO of my company?" He knew the answer he was driving at, but I only had an inkling of what he was going to say. I had them in enough courses and had been in the field with them enough to know the gist. In no uncertain terms, Dave and Chip described that they lacked the lessons about professional skills and professionalism when they graduated.

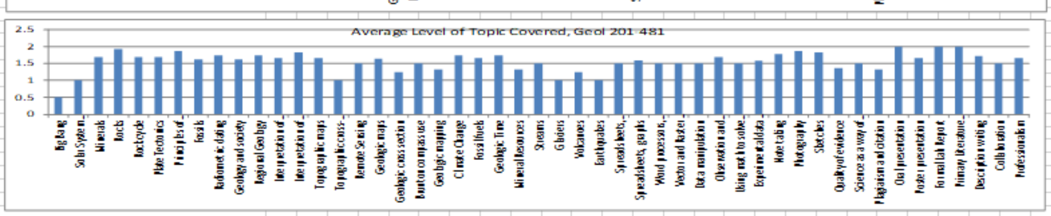
Both were competent content-knowledge geologists. They were telling us they lacked professional skills and attitudes in order to impress on us the fact that we as faculty needed to do a better job in helping our students in those so-called "soft skills". It was a challenge that Dr. Graham Baird took to heart in the decade of the 2010s (see his analysis, of geoscience courses in a matrix of knowledge skills and professional skills on the next page). There is much there to think about. Certainly, in today's world of professional geology (or meteorology, or environmental geoscience, or teaching), sophistication in those "soft skills" makes the difference in whether or not they make it past the first couple years in their career track. Nobody makes it to the level of CEO without understanding leadership and management, and a myriad of other professional skills.

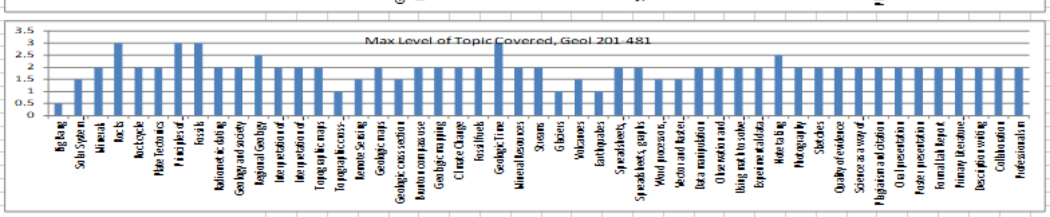
At the same time, we gained faculty and staff in our Department and across the University who actually knew something about those topics; others on our faculty had the organizational skills to design external grant programs and still others could carry out the detail work to research and assesses where we stood. Dr. Julie Sexton came to the Mathematics and Science Teaching Institute (MAST) with a Ph D in geoscience education and related areas of assessment. The Director of MAST at the time was Dr. Steve Anderson, a Ph D in volcanology with significant publications and grants in geoscience education research as well as hydrology. Added to those were two faculty in the Department with interest, publications, and grants in the broad area of assessment of student learning: Dr. Joe Elkins (geology and science education), and Dr. Lucinda Shellito (meteorologist and National Science Teachers Association member active in the National Association of Geoscience Teachers). Dr. Shellito led a Department effort with UNC's Assessment Leadership Institute to start working on geology and meteorology assessment. The secondary Earth Science Teaching major had already crafted extensive (and maybe overboard) assessment systems.

Skill or Content	Geol 100 General Geology	Geol 110 Our Geologic Environment	Geol 201 Physical Geology	Geol 202 Historical Geology	Geol 320 Mineralogy	Geol 340 Paleontology	Geol 460 Geomorphology	Geol 421 Igneous and Metamorphic Petrology	Geol 450 Sedimentology & Stratigraphy	Geol 470 Structural Geology	Geol 481 Geologic Field Techniques	Sci 291 Scientific Writing	Geol 390 Colorado Geology	Geol 410 Groundwater Geology	Geol 415 Ore Geology	Geol 445 Vertebrate Paleontology	Geol 464 Glacial and Quaternary Geology	Geol 467 Volcanic Geology	Geol 485 Tectonics	Esci 474 Principles of Hydrology	Geol 410 Groundwater Geology	ESCI 599 Seminar in Earth Sciences	Ocn 301 Physical and Chemical Oceanography	Ocn 302 Geological and Biological Oceanography	Geol 486 Petroleum and Energy	Geol 483 Soils	Sum	Count	Average	Max
Year	1-2				2-3-4				2-3-4			Electives and Other Classes																		
Semester	F/S	F/S	F/S	S	F	F	S	S	F	F	S																			
1-Introduced 2-Reinforced 3-Mastery																														
Course Content																														
Big Bang	1		0.5												2												0.5	1	0.5	0.5
Solar System Formation	1		0.5	1.5											2												2	2	1	1.5
Minerals	1		1		1.5	2		2	2				2		2		2		1				2	2	1	2	8.5	5	1.7	2
Rocks	1		1	2	1.5	2		3	3	1	2		1-2		2	2	2		1						2	2	15.5	8	1.9375	3
Rock cycle	1		1	2	1.5			2	2				2		2									2	2	2	8.5	5	1.7	2
Plate Tectonics	1	1	1	2				2	2	1.5			2		2		2		3					2	1		8.5	5	1.7	2
Principles of Stratigraphy	1			2		2			3		1		2			2	2							2	2	2	7.5	4	1.875	3
Fossils	1	1	0.5	1		3			2				2			3								1	1		6.5	4	1.625	3
Radiometric dating	1			2					2				1-2			2	2		2						1		3.5	2	1.75	2
Geology and society	1	1-2	1	2	1.5				2				2		2		1								2	2	6.5	4	1.625	2
Regional Geology	1		1	1	1.5	2		2	2	2	2.5		2		2		2.5		2.5						2	2	14	8	1.75	2.5
Interpretation of Earth Materials	1		1	2	1			2	2		2		2		2	2								1	2	2	10	6	1.666667	2
Interpretation of Earth Features	1	1	1	2		2			2	2	2		2			2			1.5					1	1	2	11	6	1.833333	2
Topographic maps	1		1			2					2		2			2	2								1	1	5	3	1.666667	2
Topographic cross-section	1		1														2						1	2	2	2	1	1	1	1
Remote Sensing											1.5		2				2								1	1	1.5	1	1.5	1.5
Geologic maps			1	2		2		1	2	1.5	2		2				2		1						2	2	11.5	7	1.642857	2
Geologic cross section			1	2						1.5	1		2											2	2	2	5	4	1.25	1.5
Brunton compass use				1					2	1	2																6	4	1.5	2
Geologic mapping				1						1	2																4	3	1.333333	2
Climate Change	1		1	2		2			2				2				1-2						1	2	1	1	7	4	1.75	2
Fossil fuels	1		1	2					2				2											1	3		5	3	1.666667	2
Geologic Time	1	1.5	0.5	2		2			3	1.5	1.5					2	1-2		2					1	1		10.5	6	1.75	3
Mineral Resources	1		0.5	2	1.5								2		2									2	1	1	4	3	1.333333	2
Streams	1	1.5	1						2				2													1	3	2	1.5	2
Glaciers	1		1										2				2-3							1		1	1	1	1	1
Volcanoes	1	1.5	1					1.5					2						1					1		1	2.5	2	1.25	1.5
Earthquakes	1	1.5	1										2						1					1			1	1	1	1
Professional Skills																														
Computer																														
Spreadsheets, equations			1		1	2			2	2	1	1					2		2								9	6	1.5	2
Spreadsheets, graphs			1		1	2			2	2		1					2										8	5	1.6	2
Word processors, advanced					1.5							1					2						1	1	1	1	1.5	1	1.5	1.5
Vector and Raster image software					1.5							1													1		1.5	1	1.5	1.5
Data manipulation			1		1				2		2												1	1	1	1	6	4	1.5	2
Scientific Methodologies																														
Observation and interpretation			1	2	1	2		2	2	2	2		2			2								2	1	1	13.5	8	1.6875	2
Using math to solve a problem			1	2	1					2		1				2	2		1					1			6	4	1.5	2
Experimental data collection			1		1	2			2	2	1.5					2	2						1	2			9.5	6	1.583333	2
Note taking			1		1.5	2		1.5	2	2	2.5	1				2						1					12.5	7	1.785714	2.5
Photography					1.5	2			2		2					2										1	7.5	4	1.875	2
Sketches					1	2		2	2	2	2					2									1	1	11	6	1.833333	2
Quality of evidence			0.5	2	1				2			1				2						2					5.5	4	1.375	2
Science as a way of knowing			0.5	2					2			1	2			2						2					4.5	3	1.5	2
Communication																														
Plagiarism and citation					0.5			2		1.5		2			1				2				1	1			4	3	1.333333	2
Oral presentation										2		1			2				2.5				2	2			2	1	2	2
Poster presentation					1			2		2		2			2				2								5	3	1.666667	2
Formal Lab Report										2													1	1	2		2	1	2	2
Primary Literature Synthesis Paper								2				2			2				2				1	1			2	1	2	2
Description writing				1	1	2		2	2	2	2	2	2			2						2			1	1	12	7	1.714286	2
Collaboration			1	2	1	2			2		1	2	2			2							2	2			9	6	1.5	2
Professionalism			1		1			2	2	2	2	2			2	2						2	1	1	2	1	10	6	1.666667	2









Putting Students First

When I think of the Department of Earth and Atmospheric Sciences (EAS), I think of a department that is actively engaged in preparing students to pursue their educational and professional goals. All of UNC's departments care about their students, but there is something special about how EAS demonstrates this care. I first came to know the faculty through their participation in the 2013 Assessment Leadership Institute. From day one, it was clear that they were serious about doing everything they could to make sure students are learning. Over the course of that year, I had many conversations with EAS faculty about the opportunities and responsibilities associated with educating UNC students, especially our large population of first-generation students. Several years before UNC launched the Strategic Enrollment and Student Success Plan, EAS faculty were talking about how to design and deliver classes and programs that are responsive to the unique experiences and challenges first generation students bring to their education. After completing the Assessment Leadership Institute, the faculty continued their commitment to student learning by securing external grants, leading assessment of the Liberal Arts Core, and creating professional development for other faculty on improving teaching and learning.

The department's last program review in 2018 offers the best example I can think of to describe this commitment to students. Program review provides an opportunity to reflect on where the department has been and to plan for the future. Identifying and requesting resources to support program goals is an important part of the process, and many programs use the opportunity to advocate for additional faculty lines. In the last EAS program review, the department's top priority was making it easier for students to find information about the program's emphasis areas on the UNC website. This seemed such a modest request, and for this reason, it stands out amongst all the many program reviews I have read over the last fourteen years. While all programs are interested in maintaining strong enrollment, this request was about more than enrollment. The faculty were concerned that students might be missing out on opportunities to pursue interests in fields such as meteorology and geology, which provide multiple pathways for professional life after college. If students can't find us because of our website, the faculty said, this is a barrier to student access. Understanding and removing barriers to student learning and success has been at the core of every encounter I have had with the EAS department. Whether they are working to improve student learning or simply asking for greater visibility on the website, the faculty of EAS consistently place student success at the core of everything they do. I probably shouldn't admit to having favorite programs, but EAS continues to hold a special place in my heart because of their steady commitment to educating students.

Kim Black, PhD, Director of Assessment, UNC

Anyway, Drs. Shellito, Sexton, Anderson, and Elkins contributed over the years in order to ferret out what made sense to the Department in the assessment universe—and what needed to be chucked as a fad or irrelevant for the students. There, I have said it plainly. I think we have in place now (mostly) what is best for our students and what faculty can do to assist students becoming professionals. We were ready to move to actualizing some of the good things that made sense. The comments of the Director of Assessment above make the case that the faculty are on the right track.

Professional Science Masters (PSM) in Environmental Geoscience

What our two alumni from 25 years prior (Chip and Dave) asked with a question grew into two major initiatives the Department designed and carried out in the decade: establishing the Professional Science Masters (PSM) in Environmental Geoscience and a two-year NSF subcontract with the Science Education Resource Center (SERC) at Carleton College through project InTeGrate called "Inviting Diverse Students to Sustain Their Future".

There were strong University moves to increase graduate student enrollment, pushed by the graduate dean and deans of the College of Natural and Health Sciences. Since we did not see a growing market in the Master of Arts in Earth Sciences, we looked to a new type of degree in the burgeoning environmental geoscience field: the Professional Science Masters. These degrees targeted emerging employment opportunities in new science fields. The fastest growing was nanotechnology, and the second-fastest growing was environmental geosciences. With our recently hired faculty and a large pool of undergraduate science grads who might like a master's degree in a year, we thought it was worth a shot. The first faculty member who really added umpf and serious scholarship in environmental sciences was Sharon Bywater-Reyes. And it really helped that the next year the Environmental and Sustainability Program hired another scientist—biologist Chelsie Romulo. Both are delightful people, already with a list of grants that would knock your socks off!

The PSM degree required a national certification process that met the basic requirements of the PSM program. A majority of the 30 credits were graduate-level science content courses, but there were several other required elements. In addition to the Master of Arts in Earth Science requirements of Graduate Research Seminars with professional scientists and Introduction to Research techniques in the discipline, there are lots of choices for elective graduate science courses the students can take. Some of those credits could be to do focused graduate research with a faculty member, though that is not required. But there are additional requirements very different from the MA in earth sciences. First, there are required credits in applied environmental geoscience courses. Then, every student must take either GIS or Applied Statistics. Each student must also take two "Professional Skills" courses, one of which must be in Communications. Our PSM Advisory Board (made up of alumni and other hiring managers in the field) insisted on the communications course—unanimously. Finally, as a capstone, the PSM program requires a 3-credit internship with a company or agency. That can all be accomplished in a calendar year, and the vast majority of students who have graduated with the PSM degree have done that. So, a thesis is not required. If a student wants to do a research thesis, they belong in a Master of Science or Ph D program. The PSM is for people who wish to go into industry or government/regulatory jobs, for the most part.

The degree program is best summarized by the document that follows. You will notice that for the capstone internship, there was a coordinator that works with the student and advisor to find just the right fit. Steve Good, a retired Ph D paleontologist, served that role in the Department through the end of the decade. Steve had oil company experience, and considerable connections in government agencies. He liked talking with government employees, and usually got them to say yes to interns. Ph D and alum Dr.Todd Dallegge taught the most popular new course we offered for both undergraduates and graduates—Petroleum and Energy. And more often than not, students got paid internships with good companies and agencies. Typically, the students had to pay a year of tuition, but after that year they could be making a very decent salary and get on with their career! Often that was with the company or agency where they had the internship.

We had several good years of that PSM program in the middle of the decade, and more than 30 students graduated. Along with that work, the Department Faculty pursued a major collaborative grant with nine faculty involved. I am sure that is a record number of faculty in the Department who ever have worked on a single grant together.

Requirements--Professional Science Master's (PSM) in Environmental Geosciences (30 cr hrs)

The Professional Sciences Master's program in the Department of Earth and Atmospheric Sciences provides students with a background in earth, atmospheric and environmental sciences as well as professional skills used for entry into industry and government jobs. To meet University requirements for a Master's degree, at least 30 hours of credit must be earned with an overall GPA of at least 3.0. No credits with a grade of C- or below can count for the degree. Of the 30 credits, at least 24 must be earned at UNC, and no more than 10 credits can count toward the degree from double-numbered (*) courses (those which also have an undergraduate section simultaneously). In other words, 20 of the 30 credits must be taken from graduate-only courses (**IN BOLD**). No more than 9 credit hours from 622 Directed Studies (**) can be taken as part of the degree, and no more than six (6) credit hours of 622 may be taken in any one semester. Frequently check your DEGREE WORKS channel on URSA to be sure all your courses are meeting the degree requirements. That includes applying for graduation and having your internship report approved as your comprehensive exam.

Required Courses – Must be taken by all students, **7** credit hours
ESCI 599 – Seminar in Earth Sciences, 1 credit hour (must be taken twice for a total of 2 credit hours)
ESCI 600 – Introduction to Earth Sciences Research, 2 credit hours
ESCI 692 – Earth Science Internship, 3 credit hours. After discussing with your advisor, contact Steven.Good@unco.edu Confirmation of minimum hours and an approved internship report is necessary.

Required Earth Science Courses. Every student must take at least **6** credit hours from the following classes:
ESCI 572* -- Industrial Safety, 3 credit hours
ESCI 605 – Global Change, 3 credit hours
GEOL 510* – Groundwater Geology, 3 credit hours
GEOL 515* – Ore Geology, 3 credit hours
GEOL 583* – Soils, 3 credit hours
GEOL 585* – Petroleum & Energy Geology, 3 crd hrs
MET 552*– Paleoclimatology, 3 credit hours

Additional Earth Science Content. Every student must take **8** credit hours from the following Earth Sciences classes:
ESCI 574* – Principles of Hydrology, 3 credit hours
ESCI 584 – Earth Sciences Field Experiences, 1-15 crd hours
ESCI 594* **–** Contemporary Field Issues, 1-15 credit hours
ESCI 695 – Special Topics in Earth Sciences, 2 credit hours
ESCI 697 – Graduate Research, 1-6 credit hours
ESCI 699 – Thesis, 1-6 credit hours
GEOL 521* – Igneous & Metamorphic Petrology, 4 cred hrs
GEOL 540* – Paleontology, 4 credit hours
GEOL 545* – Vertebrate Paleontology, 3 credit hours
GEOL 550* – Sedimentology and Stratigraphy, 4 credit hours
GEOL 560* – Geomorphology, 3 credit hours
GEOL 564* – Glacial and Quaternary Geology, 3 credit hours
GEOL 567* – Volcanic Geology, 3 credit hours
GEOL 581* – Geological Field Techniques, 2 credit hours
GEOL 570* – Structural Geology, 4 credit hours
GEOL 590 – Rocky Mountain Geology Seminar, 2 crd hrs
GEOL 622** – Directed Studies, 1-4 credit hours
MET 501* – Dynamic Meteorology I, 3 credit hours
MET 502* – Dynamic Meteorology II, 4 credit hours
MET 520* -- Advanced Weather Prediction, 3 credit hours
MET 536* – Biometeorology, 3 credit hours
MET 551* – Climatology, 3 credit hours
MET 562* -- Extreme Mountain Weather, 3 credit hours
MET 565* – Radar and Satellite Meteorology, 3 credit hours
MET 595* – Special Topics in Meteorology, 1-4 crd hours
MET 622** – Directed Studies, 1-3 credit hours
OCN 622** – Directed Studies, 1-4 credit hours

Required STEM content Courses. Every student must take **3** credit hours from the following classes:
GEOG 507 – Geographic Information Science, 3 credit hours
SRM 502 – Applied Statistics, 3 credit hours
MATH 550 – Applied Probability and Statistics, 3 crd hrs

Required professional skills Courses. Every student must take 6 credits from classes as follows:
Every student must take at least **3** hours from a graduate communications course:
COMM 512 – Persuasion, 3 credit hours
COMM 514 – Interpersonal Communication, 3 credit hours
COMM 515 – Group Communication, 3 credit hours
COMM 517 – Organizational Communication, 3 credit hours
COMM 531* – Communication and Leadership, 3 crd hrs
COMM 541* – Courtroom Communication, 3 credit hours
COMM 542 – Seminar in Political Communication, 3 c hrs
COMM 553 – Professional Speaking, 3 credit hours
COMM 610 – Communication and Technology, 3 crd hrs

Every student must take at least **3** hours of the following courses:
ART 569 – Web Style Design, 3 credit hours
BAAC 527* – Governmental and Institutional Accounting, 3 credit hours
BAMG 554 – Managing and Developing People, 3 credit hrs
CH 550 – Environmental Health, 3 credit hours
ELPS 601 – Leadership Development through Inquiry,3 cr hrs
ELPS 662 – Design, Delivery, Professional Development, 3 credit hours
ENST 515 – Sustainable Solutions – Environmental Problems, 3 credit hours
ET 601 – Managing People, Projects & Tech Systems, 3 cr hrs
INTR 560* – Ethics in Leadership, 3 credit hours
SES 500* – Wilderness First Responder, 3 credit hours
SOC 530* – Organizational Analysis, 3 credit hours
SPAN 503 – Spanish Conversation, 3 credit hour

Checklist Form for Professional Science Master's Program in Environmental Geosciences

(PLEASE list graduate-only course prefix and #; 20 of the 30 credit hours must be **BOLD).**

Student Name: _____Bear Number:_____

Earth Science Required Courses. 7 credit hours (credit hours) required

Course Prefix #	Name of Course	Cr Hrs	Semester/Year
ESCI 599	Seminar in Earth Sciences	1	
ESCI 599	Seminar in Earth Sciences	1	
ESCI 600	Introduction to Earth Science Research	2	
ESCI 692	Earth Science Internship	3	

Required Earth Science Courses, 6 credit hours required

Course Prefix #	Name of Course	Cr Hrs	Semester/Year

Additional Earth Science Courses, **7-8** credit hours required

Course Prefix #	Name of Course	Cr Hrs	Semester/Year

Required STEM Content Course, **3-4** credit hours required.

Course Prefix #	Name of Course	Cr Hrs	Semester/Year

Elective Set 3 Courses – Professional Skills, 3 credit hours of COMM & 3 cr hrs of other are required.

Course Prefix #	Name of Course	Cr Hrs	Semester/Year
COMM		3	
		3	

Company or Agency Name:_____

Contact Person: _____Dates of Intern Service: _____

Description of Internship work: _____

_____

Project InTeGrate 2015-2017

Cindy Shellito and I (along with other faculty some years) attended meetings of the SERC/NAGT Earth Educator Rendezvous during the summers. Cindy had the idea of applying as a department for a grant for an NSF subcontract with them. Cindy was Editor of *In The Trenches*, the NAGT quarterly publication that provides a

forum for geosciences educators in the classroom, among other things. Cindy also served NAGT as a site visit team member for other college geoscience departments. Though Cindy was hired at UNC as a meteorologist/climatologist, she had much experience and knowledge working with geoscientists and science educators as well. Some of her research interests include publications in paleoclimatology in deep geologic time. She is also a Fulbright scholar. In short when she talks, people listen and often take her advice. That's hard for most Ph D recipients to do, but people in the Department have learned to do so. Like Dr. Dick Dietz in the earlier decades, Dr. Shellito has mastered the craft of not running on at the mouth. That means that when she has something to say in a faculty meeting, people listen carefully.

InTeGrate stands for Interdisciplinary Teaching about Earth for a Sustainable Future. When a few of us faculty went to an Earth Educator Rendezvous meeting in Boulder in 2015, we met with Cathy Manduca, the Executive Director of SERC, Executive Director of NAGT, and prime mover in many national initiatives. We had a productive discussion with Cathy and other SERC staff about what kind of work they were seeking, and how the Department of Earth and Atmospheric Sciences could be involved. We heard their interest in having traditional *upper division* geoscience courses retooled from the perspective of sustainable resource issues, and especially so that underrepresented groups would be engaged in better ways. There was also major interest in engaging in other curricular areas with earth systems engagements. We certainly hoped such strategies would help with recruiting at UNC and specifically in our Department. Courses of interest were Geomorphology (Joe Elkins), Mineralogy (Graham Baird), Paleoclimatology (Cindy Shellito), Paleontology (Emmett Evanoff), Introduction to Environmental Earth Science (Steve Anderson), Scientific Writing (Byron Straw), Physical & Chemical Oceanography and Geological and Biological Oceanography (Bill Hoyt). All but Paleontology were eventually engaged with course revisions. Many curricular innovations were crafted by our faculty into units for national distribution *via* the SERC website.

Departmental Strategic Planning

Cindy and I also engaged with another large NSF grant project headed by Sharon Mosher, Dean of the Jackson School of Geosciences at the University of Texas, Austin. Sharon just got a prestigious International Geological Leadership award in April, 2020 from the Geological Society of America. Earlier, Joe Elkins and I had gone to one of the meetings there to work on what the new geoscience curriculum ought to look like in U. S. universities. Dr. Mosher engaged as many geology and GEO/MET departments around the country as would play ball around the question, "What Does a Strategically Wise Future Look Like in Your Department" (I paraphrase). Cindy and I worked with the Department, the Deans, and others over several years to come up with several bullets under that big question. The final report Cindy sent in last month to Dr. Mosher identifies what has been accomplished in the last few years. It starts with Dr. Mosher's questions (*in italics*) about the outcomes of our Action Plan {lightly edited}:

A) *How much progress have you made with your plan? If you have modified your plan since then, in what way did it change and why?*

We had basically 3 goals as an outcome of this workshop:

1) **Improve communication about teaching among faculty in the program:** In the past couple of years, we have attempted to improve communication through regular discussions on teaching at faculty meetings. At each meeting, one person would share a strategy, teaching idea, or classroom experience. This has given us a much better understanding of the teaching style of our peers – and, I think, paves the way for communication beyond the faculty meetings. We did this in our faculty meetings for two years, but dropped it for a while this past year, when we had too many other things to attend to. I

think everyone enjoyed hearing about what everyone else is up to and that we will pick it up again when circumstances allow us a bit more time (and face to face meetings again!)

2) **Open faculty discussion about ways to continue retaining students and preparing them for their careers:** This type of discussion is ongoing within our department. In September of 2019, we held a two-day retreat with facilitators from NAGT's Traveling Workshop Program. This was a primary topic of discussion. As a result of our discussions over the past couple of years and the TWP retreat, we have:

   o Revised our Environmental Science curriculum to include classes with a bit more rigor, but also a bit broader range across the Earth Sciences – This included, developing an 'Earth Materials' course for majors in Env Sci, a discipline-oriented statistical analysis course taken by all Earth Sci majors (Geology, Meteorology, and Env Sci), and an Earth Science Professional Development Seminar course for all Earth Sci majors. The professional development course helps students become aware of career prep resources on campus and in the discipline, learn to write resumes, practice interviews via video conferencing, etc.

   o Developed an introductory-level course called 'Our Violent Earth' which includes the most exciting elements of geology and meteorology. The hope is that this course will pique interest in Earth Sciences among a broad range of students.

3) **Smooth transition in departmental leadership over the next two years:** At the time that we attended the workshop in Albuquerque, we knew that Dr. Hoyt would be retiring soon, and we were concerned about how to transition to new leadership. By sheer luck (and transitions in university administration), we were offered the opportunity to conduct a national search for a new department chair. This resulted in the hire of Dr. Tim Grover. Dr. Hoyt stepped down as chair in Fall 2018, but remained at work full-time until Spring 2019, and we were all able to draw on his wisdom and expertise during that time.

B) *What has been accomplished, whether it was in your original plan or not?*

I think I've mostly answered this above.

C) *What are your future plans?*

The dire budget situation of the university has left us in a position of trying to offer our courses in a much more efficient manner (every-other year, for example), doing everything we can to retain current students, and increase enrollment, if we can, in all of our classes. I think our plan, at this point, is to hold on and weather this storm, and continue to look for ways to continue well!

D) *Which implementation strategies worked – i.e. what was successful, and what wasn't?*

We feel that the NAGT TWP workshop was very much a success – we had a lot of great discussions and ideas about possible course offerings – an outcome of these discussions was the development of the Violent Earth course.

E) *What were roadblocks to progress or where did problems occur? And if you were able to overcome them, what did you do?*

I think we are just beginning to hit roadblocks. Because of budget cuts in the past year, we are losing our department admin assistant, as well as our lab and internship coordinator. We are not yet certain how we will operate without our admin assistant, who has worked in our department for decades, and on whom we relied

extensively for her institutional knowledge, and her work in helping students find what they need. We have no idea if we will continue to have funds to support faculty travel or research, or even maintenance of the department copier. We are also likely to face greater financial uncertainties in the coming year due to the COVID crisis. I suppose, on a positive note, we are all learning how to teach online!

F) *What did you anticipate would be a problem that wasn't?*

I think we expected greater challenges in transitioning department leadership – We were VERY fortunate to be able to not only conduct a search, but to hire such an experienced leader as Dr. Tim Grover (photo to right).

G) *Any advice to others who wish to make similar changes?*

The only thing I will say here is that paving the way for regular discussion among faculty is critical to having a functional department. Regular discussions on teaching can dispel preconceptions about what your colleagues may be doing – they can also lead to greater cohesion and integration in the curriculum, along with new course ideas and teaching strategies. I believe we can do better at this – but also believe that regular discussions have improved the atmosphere in our department considerably. As we move toward figuring out how to operate under new challenges (whether that be a financial crisis, a global health crisis, or, both), I think this communication and teamwork will be critical to keeping our department afloat in uncertain times.

Meanwhile, back at the research labs in Ross Hall, we were busy acquiring and installing new equipment. Most of it the students did get to see, but some was sequestered in the X-Ray lab. Nesse had arranged a capital equipment purchase of a mobile X-Ray diffraction unit beneficial in mineral identification in fine materials. There is also a newer "Single Crystal" unit obtained in conjunction with chemistry, used primarily in materials characterization and materials research areas.

A Major Switch

Switching my major to Environmental Earth Sciences was truly the best choice I think I made in my time at UNC. I loved my time in the Earth and Atmospheric sciences department; from the candy and chats with Vicki, to the field trips on the barge.

One of my favorite memories of my time in the department was the four-day field trip around the state for Colorado Geology, taught by Dr. Evanoff. I've lived in Colorado my whole life, but this trip showed me corners of the state that I had never even heard of. Radium Hot Springs is one example of the places we stopped that I had never been to. We stopped on our way to Gunnison to find this incredible purple quartz! I still have the samples I found on my desk at home.

That trip was also full of fun memories beyond all the things we learned. The first night of the trip, it was freezing and someone in the camp snored all night. We woke up to tents covered in a layer of frost, and some grumpy attitudes. The next night, some of us sat under the stars and the full moon at the Colorado National Monument, just talking and laughing. On the last night, Dr. Evanoff had stopped somewhere along the road to pick up two crates of Palisade peaches for all of us. We ate the best peaches in the world, and then had peach cobbler for dessert that night around a roaring campfire.

Not every department offers opportunities like that, and I will never take that trip for granted. Even though we had to study for other tests between stops, and we were all pretty ready to get home after four days, this is one of my favorite memories from college.

It wasn't just big moments like camping trips that made my time special. Even the little moments of college life were fun. I loved meeting up with my friends in the upstairs computer lab to study, work on homework, and hang out. Even the nights that we had to cram for a lab practical, sitting in the lab licking minerals or trying to remember the names of fossils were memorable. Working on the puzzles that Vicki had set out and petting Dr. Lerach's dog was always a welcome break from classwork and studying!

I am so grateful to all the professors, staff members, and grad students who helped make my time at UNC so wonderful.

Katie Fletcher, Class of 2018

Welcome, Welcome

When I was an undergraduate, I decided to major in Geology because I felt a relaxed happiness among the rocks, minerals, and people. This feeling told me I had discovered my career. I felt these same reassuring feelings when I first walked down the hallway, past the rock and mineral displays and into the UNC Earth and Atmospheric Sciences Department's office.

I have always felt accepted by everyone in the department. I knew I could walk into the office and talk with Vicki while I worked on a puzzle or enjoyed some candy that she generously provided. I continue to remember animal cracker Mondays, which always makes me smile, and think of the kind and wonderful gesture of providing these sweet treats. Because even on a Monday, you just have to be happy when eating animal crackers.

Also, I do believe in signs. On my first day at the new graduate student orientation I began a conversation with two students while waiting for the trolley that would take us on a campus tour. As we talked, one of the students, her name is Davitia, and I discovered we were both geologists, TA's, and beginning the same Masters' degree in the Earth and Atmospheric Sciences Department. Davitia would become a close friend of mine.

Additionally, when I first met my advisor, Steve, Dr. Steve Anderson, I felt I was making the right choice in schools. One because he knew of the school where I attended as an undergrad, which I took that as a good sign. Two because I felt at ease talking to him. We have similar research interests and I knew we would work well together, and I feel so appreciative for the support and guidance I received from him.

Initially, Dr. Hoyt, was my advisor and as nervous as I was starting a new school and beginning my Masters, Dr. Hoyt boosted my confidence by talking about what to expect as a TA, what classes I needed to complete, and that he was there to help however he could. I am thankful that he was a member on my thesis committee as I knew I could rely on Dr. Hoyt to take time to talk to me as I worked through the different stages of writing and defending my thesis.

I am extremely happy that I am a part of a department that cares so much for its students, faculty, and staff. Speaking of my thesis, I knew I could count on my department to help me when I needed rock, mineral, and fossil donations for my research. Dr. Evanoff's generous donations enticed many an ungraduated student to take part in my interviews.

Because of the department's welcoming community, I got to know the different professors within the department whether they taught geology, oceanography, or meteorology. Even now, after graduating I know I can go back and have a conversation with whoever I bump into that day and we will be happy to see each other.

I also made amazing friends, whom I am so happy I spent the many hours earning my degree, laughing, hiking, camping, studying, smiling while talking about Morgan's pet bird as a tiny dinosaur, and stressing over projects, classes, and our final papers or theses. So many great memories that I will cherish.

Mandy Manzanares, MA (Thesis)

YEARS OF CHALLENGE, MENTORSHIP, AND LIFE-LONG FRIENDSHIP

My time at UNC Earth & Atmospheric Sciences Department began in 2012 as a transfer from CSU. I walked into the office and was immediately greeted with a large bubbly, "Hello," from Vicki, and a direction to take some candy from the dish on her desk. "Friendly staff and free candy, transferring was definitely the right decision," I thought. After a month in my first Dr. Baird class, I thought, "What in the heck did I get myself into!" Nonetheless, I stuck it out and I am so glad I did. A few weeks later, I was training with the Bell's Running Group and Dr. Baird showed up ready for the workout. He looked quite surprised to see me, I knew I could not let him beat me… so I didn't. "Your pretty fast," he mentioned, I said the same about him, thinking, "He looks a bit-tired hope he will be ok." During my time at UNC, Dr. Baird and I faced off in the Bell's Running Group several times, though he never beat me, we gained an increased appreciation for each other. Through the comradery of the running group and the countless hours studying for his extremely hard exams, Dr. Baird became one of the many wonderful mentors that I gained during my time at UNC. The photo to the right is of Hoyt and Marshall Parks (Director of Human Resources), eating the dust of Shawn and Graham, who are way up there ahead of us somewhere.

Dr. Hoyt consistently expressed the importance of creating and expanding a network of individuals. Through the Department courses, field trips, and internships I made many life-long friends and mentors. The challenging hands-on curriculum expanded my insight as a geologist and excelled me past many of the other individuals I've encountered during graduate school and in my career as a Geologist. Every aspect of my time at UNC, from creating thin sections, conducting independent studies, looking at countless

fossils with Dr. Evanoff, field mapping with Dr. Baird, spending countless hours at the Poudre Learning Center, and gaining intrinsic lifelong relationships, has not only shaped my career as a Geologist but aspects of my everyday life.

Shawn Dubbs, M.S., Licensed Professional Geologist

Four Days of Growth to Remember

I graduated from the M.A. Program in 2012 and fondly remember Dr. Evanoff's four-day Sedimentology and Stratigraphy field trip over Spring Break. Our rag tag group of students included a mom with young kids, old kids not long out of high school, a couple of semi-loner stragglers, a delicate waif, and me, a second career geologist wannabe, among others. The first night we camped at Colorado National Monument near 7,000' and shivered through a snowstorm. My tent walls slapped my face as they heaved and bulged with each burst of wind through the night. Despite the soggy morning, the prof was up early, chipper and buzzing around. He oversaw breakfast, directed an efficient cleanup, then lead us along the winding walls of Precambrian up through the Lower Cretaceous rock. The sun brightened and warmed the day and just as I was settling into what I expected was a leisurely guided tour, he handed out an assignment and disappeared. Four pages front and back! We crowded close to the vertical rock walls with clip boards and hand lenses, pointing and tapping, mapping contacts and describing hundreds of feet of contorted gneiss, bright red mudstone, and cross bedded sandstone. Dr. Evanoff would periodically pop by to offer hints and keep us on track. By afternoon we were sunburnt, dusty and parched, but the pace never slackened. Over the next few days, we traced a circuit through the Southwest, camping near endless canyons and exposed mesas, sweating by day and talking and laughing through the frigid nights. Although we had vastly different backgrounds, we melded together, against the rocks, around Dr. Evanoff, and shoulder to shoulder in the packed field camp vans. I learned so much about geology, but also about how to tolerate discomfort, carefully observe, thoroughly catalog, and solve spatial problems with my hands. Those few days of spectacular formations, Dr. Evanoff's energy and knowledge, giant bags of trail mix, and my utter exhaustion and brimming enthusiasm came to define my years in the Earth Sciences program at UNC.

Sharon Sadle, M.A., 2012

2020 Vision & Uncharted Horizons

COVID-19 has reset the future in ways I shudder to think about. But even before late 2019 the new UNC President, Andy Feinstein, took on the job of erasing a $10 million structural deficit that would recur every year unless things changed drastically. A fine "howdy-do" to be welcomed to a new job with a colossal fiscal hole like that! But Andy's motto "Rowing Not Resting" expresses UNC positive outlook perfectly. However, over the discussion that follows, there is a pall of pandemic and paucity. And don't we all wish we had 20/20 vision? How ironic for this year of 2020 when no one can see into the future very well!

The Department has a solid and well-thought-out vision for the future. That vision has been honed and infused with wise choices over the last decade or so. It has been underpinned with extensive work and careful thought by the faculty and Departmental and College leadership. Where it goes from here is controlled by many factors. But if it depends on past accomplishments and a strong alumni base, we should be in good stead! Moreover, throughout UNC there is much good will and interest in collaboration with the Department of Earth and Atmospheric Sciences. Keeping it that way is the monumental challenge of the 2020s!

President Feinstein and Provost Anderson have a monumental task facing them for the 2020-2021 academic year. Will the University be able to reopen for full face-to-face classes in the fall of 2020? Will enrolled students return, and will new students be recruited in healthy numbers? All the questions that are up in the air also effect every department and every office. There are some monumental barriers to easy answers, but we have climbed mountains, ventured to the stratosphere and beyond, and descended into the depths of the sea. WE GOT THIS!

Next week I plan to embark on a 2100 nautical mile adventure with my best friend (Jim) from graduate school: we have charted a course from Houston to Annapolis on his J-46-ft. racing sailboat. We started planning this before COVID-19 hit, so you can imagine what has changed in our planned "course" just in the last three months. There were to be at least 3 crew for the first leg to Florida, but last night Jim notified me that our 3rd crew member had his house hit by lightning, and there was a fire. Gary Huffines and Dick Orville spent much of their professional careers studying lightning hazards, mostly in the Houston area; it is much easier to accept what I read in their papers now—I believe you two now more than ever! Once we got on the water, wind direction and speed were much more challenging and different than was forecast and the threat of tropical storms/hurricanes was more in play. We took two crew members ashore at Port Fourchon (miss it if you can). Seasickness, low blood sugar, and hypothermia ensued and we were minutes from enacting a sea rescue from the Coast Guard.

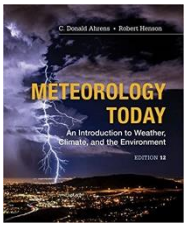
This time of year, it is pretty sketchy to get reliable marine forecasts. Angel Enriques knows that first hand since that is what he does for marine transportation companies. In the photo to the right, I am seriously trying to break the sea-speed record of Sodalis III for the cruise, which was 12 knots (14 mph).

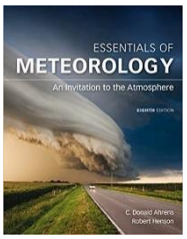
So, just as we had the option of returning to port under threat, the Department of Earth and Atmospheric Sciences can hope to find safe havens during the coming years. I'll pray that.

Top Books Published by the Faculty or Alumni Over the Decades

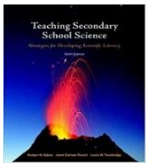
1. Jay Hackett (faculty in Science Education and Earth Sciences), Various Elementary Science Textbooks (too many to list) grades K-6 (***maybe millions of copies published in 1980s, 1990s, and 2000s)*** with fellow UNC alumnus Richard Moyer and others. Many nationwide in distribution, some in other languages, but several states contracted Jay to do their own elementary science textbooks and activity guides (e.g. California, Indiana, Ohio, Tennessee, New Jersey). Jay would wander the Department endlessly, asking astronomy questions of Dick Dietz, geology questions from his geologist *du jour*, meteorology questions of Glen Cobb or Les Trowbridge, and oceanography questions of Richard Slater or Bill Hoyt. Because Hoyt's office was next to Jay's for several years (and we frequently hung out after dinner in the office) I got lots of questions in oceanography and geology. Sadly for us, but happily for the country, Jay went on sabbatical to the National Academy of Sciences to write the National Science Standards with Rodger Bybee and others. They liked his work so well that NAS bought UNC out to allow Jay to stay for a second year in Washington, and then Jay retired. I don't think any UNC faculty member has ever been allowed to do both those things in subsequent years (both are "strictly" against policy-AHEM).

2. Richard Ahrens (alum), Meteorology Today, published in 12 editions from the 1960s to 2019, and Essentials of Meteorology, published in 8 editions from the 1970s to 2017. College meteorology texts totaling ***(maybe 100s of thousands to millions of copies over six decades)***. Ahrens is, by far, the most widely read meteorology writer worldwide and has won longevity awards from the publishing industry. In short he has crushed the competition. I invited Ahrens twice to send me materials associated with honored alumni nominations, but to no avail. Either he is too humble, couldn't be bothered, or was too engaged in Napa Valley vino!

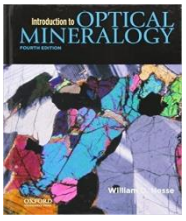


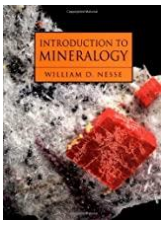


3. Les Trowbridge (faculty and former chair of Science Education), Rodger Bybee (faculty teaching assistant), Janet Powell, 9 Editions of Teaching Secondary School Science: Strategies for Developing Scientific Literacy, published from 1967-2008 (***maybe hundreds of thousands of copies published over five decades***). Related titles concerning inquiry science and Biological Sciences Curriculum Study (BSCS) projects as well.

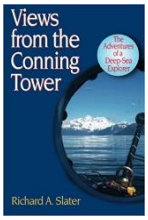


4. William Nesse (faculty and former chair), Introduction to Optical Minerology, published in 4 editions from 1986-2012, and Introduction to Minerology, published in 3 editions from 1999-2016, both by Oxford University Press. Both are at or near to being market leaders for college classes, totaling ***(maybe 10s of thousand copies published over 3 decades)***. Best known by UNC geology majors because if a student found any kind of error in the book, Nesse paid them $1 on the spot (or $5 in later years!)

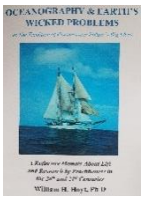




5. Richard Slater (faculty and former chair), Views From the Conning Tower: Adventures of a Deep-Sea Explorer, published in two editions from 2012-2015 ***(maybe hundreds to thousands of copies)***. If you would like first-hand accounts of what it was like to be in the department and chair in the 1970s, read his chapter on the UNC years. He was one of the more notable faculty members UNC ever produced.



6. William Hoyt (faculty and former chair), the Tradition of Franklin and Folger's Big Research by Practitioners in the 20th and because it is the first digital book to ***downloads in the first year, <50 print***



Oceanography and Earth's Wicked Problems, in Ideas: a Reflective Memoir about Life and 21st Centuries, 2019, which shows up here only come out of the Department ***(250+ digital copies)***. Find that memoirs volume at: https://digscholarship.unco.edu/easfacpub/1/ The present volume is also destined to be found in digital form under my name in the Earth & Atmospheric Sciences digital archives, if it can pass UNC Imprimaturs.

Sample Research or Publications of the Faculty (some incomplete, and only a small sample)

1. Libarkin, J.C., and ***Anderson, S.W.,*** 2005. Assessment of Learning in Entry-Level Geoscience Courses: Results from the Geoscience Concept Inventory; Journal of Geoscience Education; v. 53. p. 394-401.
2. ***Anderson, S.W.,*** Stofan, E.R., Plaut, J.J., and Crown, D.A., 1998, Block size distributions on silicic lava flow surfaces: Implications for emplacement conditions, Geological Society of America Bulletin, v. 110, p. 1258-1267.
3. ***Baird, G. B.,*** and Shrady, C. H., 2011. Timing and kinematics of deformation in the northwest Adirondack Lowlands, New York State: Implications for terrane relationships in the southern Grenville Province. *Geosphere, v.* 7, no. 6, pp. 1303-1323.
4. ***Bybee, Roger W.,*** 2014, The BSCS 5E Instructional Model: Personal Reflections and Contemporary Implications, Science and Children, National Science Teachers Association, v. 51, no. 8, pp. 10-13.
5. ***Cobb, L. Glen,*** 1963, On the Effects of Atmospheric Refraction on Radar Ground Patterns, Ph D Dissertation, Texas A&M University. Glen also undertook one of the first scientific studies of the ENSO phenomenon in the southern Pacific Ocean, as well as Central American cloud seeding projects.
6. ***Dietz, Richard,***1965, The Formation of the Solar Lyman Continuum, Ph D Dissertation, University of Colorado.
7. ***Elkins, Joe,*** Elkins, N.M.L., and Hemmings, S.N.J. " GeoJourney: A nine-week introductory field program with an interdisciplinary approach to teaching geology, Native American cultures, and environmental studies" *Journal of College Science Teaching*, v. 37, n. 3, pp.18-28, 2008. Joe was also the co-editor for Technology, Journal of Geoscience Education, and recipient of the Biggs Award from the Geological Society of America for excellence in geoscience teaching (
8. ***Erasmus, Andre,*** 1984, Ph D Dissertation, University of Hawaii, and *circa* 1994, Nocturnal Airflow into the Greeley Area *via* River Valleys. Andre was from Cape Town, South Africa.
9. ***Evanoff, E.,*** Murphey, P.C., Haessig, J.E., Smith, A.A., and Matthews, N., 2007, Bedrock geologic map of the Reed Reservoir 7.5' Quadrangle, Sweetwater County, Wyoming: Wyoming State Geological Survey OFR, 1 sheet (scale 1:24,000).
10. ***Finley, Catherine,*** 1998, Ph D Dissertation, Numerical Simulation of Intense Multiscale Vortices Produced by Supercell Thunderstorms, Colorado State University. Cathy and Bruce Lee were the two MET faculty during the late 1990s and early 2000s when we had some 50 MET majors. During those years there were more met majors than geology majors. Bruce and Cathy's large NSF grant on tornado rear flank downdrafts provided some storm-chasing opportunities that attracted many students. When they both left UNC to work for WindLogics, they took the remaining years of the NSF grant with them.
11. ***Flynn, Wendilyn,*** and S. W. Nesbitt, 2015, Simulating the diurnal cycle of convection in the Sierra Madre Occidental during the North American Monsoon: Impacts of soil moisture initialization, Journal of Hydrometeorology.

12. ***Grover, T.W***., Pattison, D.R.M., McDonough, M.R, and McNicoll, V.J. (1997) Tectonometamorphic evolution of the southern Taltson magmatic zone and associated shear zones, northeastern Alberta, Canadian Mineralogist, v. 35, p. 1051-1067.
13. ***Hopkins, Ken*****,** and ***Hoyt, W. H.,*** 2003, Understanding Weld's Ground Water, Greeley Tribune, Water Series, 3/16/03.
14. ***Hoyt, William,*** 1991, Migrating east Australian barriers and reefs under Greenhouse scenario, in Kraus, N. C., Gingerich, K. J., and Kriebel, D. L., eds., Coastal Sediments '91, American Society of Civil Engineers, v. 2, p. 1329-1342.
15. ***Hoyt, William,*** Kraft, J. C., and Chrzastowski, M. J., 1990, Prospecting for submerged archaeological sites on the continental shelf; Southern mid-Atlantic Bight of North America in Lasca, N. P., and Donahue, J., eds., Archaeological geology of North America: Boulder, Colorado, Geological Society of America, Centennial Special Volume 4, p. 147-160.
16. Scott M. Steiger, Richard E. Orville, ***Huffines, Gary,*** 2002, Cloud-to-ground lightning characteristics over Houston, Texas: 1989–2000, Journal of Geophysical Research, https://doi.org/10.1029/2001JD001142 . This research and related work on lightning is tremendously important for the commercial airline industry (e.g. Huffines' research at George Bush Intercontinental Airport in Houston), and is the principal research source for today's practice of waiting 30 minutes after the last visible ground strike to resume outdoor activities (e.g. rain delays at ML Baseball games, etc.).
17. ***Lee, Bruce,*** and Robert B. Wilhelmson, 1997, The Numerical Simulation of Non-Supercell Tornadogenesis. Part I: Initiation and Evolution of Pretornadic Misocyclone Circulations along a Dry Outflow Boundary, Journal of Atmospheric Research, https://doi.org/10.1175/1520-0469(1997)054<0032:TNSONS>2.0.CO;2 .
18. ***Lerach, David*****,** and W. R. Cotton, 2012, Comparing Aerosol and Low-Level Moisture Influences on Supercell Tornadogenesis: Three-Dimensional Idealized Simulations, *Journal of Atmospheric Sci*ence, v. 69, pp. 969-987.
19. ***Morrow, Jared,*** 2007, Shock-metamorphic petrography and microRaman spectroscopy of quartz in upper impactite interval, ICDP drill core LB-07A, Bosumtwi impact crater, Ghana, Meteoritics & Planetary Science v. 42, no. 4/5, pp. 591–609 (2007), doi http://meteoritics.org .
20. ***Nesse, William,*** 1988, GEOLOGIC MAP OF THE RUSTIC QUADRANGLE, LARIMER COUNTY, COLORADO, By Kenneth C. Shaver, William D. Nesse, and William A. Braddock, GEOLOGIC QUADRANGLE MAP Published by the U.S. Geological Survey, U. S. Department of the Interior.
21. ***Shellito, Lucinda*****,** L.C. Sloan, and M. Huber, 2003, Climate model sensitivity to atmospheric CO2 levels in the early-middle Paleogene, *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 193, pp.113-123. **This paper was awarded Elsevier Publications 'Most Cited Paper 2003-2007 Award' for being one of the top 50 most cited papers in this journal.*
22. ***Slater, Richard,*** 1981, Submersible observations of potential geologic hazards along the mid-Atlantic outer Continental shelf and uppermost slope, Richard A Slater, David C Twichell, James M Robb, Geological Survey (U.S.), United States Bureau of Land Management, U.S. Dept. of the Interior, Geological Survey, Open-file report, pp. 81-968.
23. ***Taber, Michael,*** 1998, The Importance of Heat Storage in the Surface Energy Balance for a Constructed Wetland, Ph D Dissertation, Iowa State University.

Sampling of a Few Grants Obtained by the Faculty

- **Anderson, Steven,** NASA-GCCE – (PI), NCAR Global Climate Change Research Experience for Teachers, 2010-2013, $437,103.
  NASA - Mars Fundamental Research (PI), "Mars Lava Flow Surface Morphology: An Avenue for Answering Fundamental Questions Regarding the Rates and Styles of Volcanism", 2004-2008, $162,660.

- **Baird, Graham,** (co-PI) National Science Foundation Major Research Instrumentation (Chemistry Division); "MRI-R^2: Acquisition of a Scanning Electron Microscope for Research and Research Training at UNC", 2010, (authorship: Pacheco, K., **Baird, G. B.**, Brunswig, R., and Macaluso, R. T.), $371,800.
- **Bybee, Rodger,** after he left UNC, he Directed the Biological Sciences Curriculum Study (BSCS) in Colorado Springs, worked on a plethora of NSF research and curriculum/teacher education grant programs, and then led the National Research Council's National Science Standards work for some years in Washington, D.C. Probably $10s of millions in grants over the years.
- **Elkins, Joe,** (co-PI), National Science Foundation (REESE) Collaborative Research: Learning across the Expert-Novice Continuum: Cognition in the Geosciences $434,581, Libarkin., J., Petcovic, H. Hamrbick, Z., Elkins, J. (2010).
- **Evanoff, Emmett,** (PI), Mineralogical and Geochemical Evidence for Volcanic Sources of the Florissant Formation, Florissant Fossil Beds National Monument; $20,000 grant for four-year project (2010-2014), National Park Service. Funds from this grant have been used in setting up the mineral separation laboratory at UNC.
- **Finley, Catherine,** (co-PI), National Science Foundation, Rear-flank downdrafts in Tornadogenesis… with Bruce Lee, 2001-2003, about $250,000 if I remember correctly.
- **Flynn, Wendilyn,** (co-PI), 2014 - NSF Major Research Instrumentation (MRI); "Acquisition of a High-Performance Computing Cluster for Multidisciplinary Research and Education at the University of Northern Colorado." $139,948. Frietze, S., Mostowfi, M., Hydock, D., Lerach, D., Flynn, W. Awarded Aug 2014.
- **Grover, Tim,** and Newberg, Donald W., 2016, Reconnaissance bedrock geology of the Damariscotta quadrangle, Maine: Open-File Map 16-22, Maine Geological Survey, Augusta, Maine, p. 1 sheet. Stipend amount is flynnunknown. {Comment by Hoyt: Damariscotta is where three of my good friends have retired so I WILL go check out the work!}
- **Hoyt, William,** (PI)/subcontr. w/CSU, National Science Foundation, MSP Targeted Partnership: Culturally Relevant Ecology, Learning Progressions, and Environmental Literacy, 2008-2015, $859,000.
  (Co-PI & PI), National Science Foundation, GK-12 TRACK II: Colorado Front Range Human Impacts, 2005-2010 on subcontr. w/CSU 2007-2010, $1,800,000.
- **Huffines, Gary,** (co-PI), UNIDATA Corporation, equipment and data-handling grant, 2006-2007 $20,000. This grant brought the MET program about a dozen dual-boot (Windows and LINUX) computers for the MET lab and classroom, which have continued to be refreshed since. Dr. Paul Nutter was co-PI on the project.
- **Lee, Bruce,** (co-PI), National Science Foundation, Rear-flank downdrafts in Tornadogenesis… with Cathy Finley, 2001-2003, about $200,000 if I remember correctly.
- **Lerach, David,** (co-PI), 2014 - NSF Major Research Instrumentation (MRI); "Acquisition of a High-Performance Computing Cluster for Multidisciplinary Research and Education at the University of Northern Colorado." $139,948. Frietze, S., Mostowfi, M., Hydock, D., Lerach, D., Flynn, W. Awarded Aug 2014.
- **Morrow, Jared,** (PI), National Science Foundation and American Chemical Society, Alamo Breccia and other explosive impact craters in the geologic record (by ACS Petroleum Research Fund). About $80,000 as I recall.

- **Shellito, Lucinda,** (PI), Fulbright Core Scholar Grant. *Integrating Meteorological Investigations into an Interdisciplinary Earth Science Curriculum to Explore Weather and Climate Variability in the Andes.* Award amount supported a six-month visit to pursue research and teaching activities with colleagues at the University of Cuenca in Ecuador from February-July 2015, $22,800 + travel expenses**.** Other grant awards supported the work while she was on sabbatical in Ecuador. A field study trip in Ecuador ensued with UNC students—and Dr. Anderson to teach about volcanoes.
- **Shropshire, Lee,** (co-PI), National Science Foundation subcontract, Earth Science Curriculum Project, Summer Workshops for Teachers, during the mid-late 1960s, $unknown.
- **Taber, Mike,** (PI), NASA/USRA grant developed a global change capstone course for UNC, $58,697.

Information About Some Current and Past Faculty

Steven Anderson
Hometown – Green Bay, Wisconsin
Courses you teach – Our Earth's Environment
What do you like about teaching? That I know I'm making a difference by helping students understand issues that will affect them in the future, whether they are an Earth science major or just taking my course as an elective.
What got you interested in your field of study? I was dead-set on going to medical school until my first day in a Physical Geology class. I knew during that first class I had found something I truly connected with and was passionate about
Hobbies / Interests – running, cycling, hunting, fishing, backpacking, annoying my wife and daughter.
Anything else you'd like to share about yourself – 8-time Ironman triathlon finisher, and my bike is worth more than my car.

Graham Baird
Hometown – Holland Patent, NY
Hobbies / Interests – Cross-country ski racing, orienteering, road and trail running, road and mt. biking, hiking, canoeing, fishing
Courses you teach – Geol 100 – General Geology, Geol 201 – Physical Geology, Geol 320 – Mineralogy, Geol 421/521 – Igneous and Metamorphic Petrology, Geol 470/470 – Structural Geology, Geol 481/581 – Geologic Field Techniques, Geol 422/622 – various Directed Studies topics (typically Geochronology or Tectonics), Sci 291 – Scientific Writing, ESCI 599 – Seminar in Earth Sciences
What do you like about teaching? I like showing students all the interesting and "cool" things about how the earth works. It is very satisfying to help students understand and enjoy geology.
I have always been interested in mountains and the outdoors, initially because that is where I would ski, run, hike, etc. As an undergraduate, I learned in my first geology class that I could in fact make a career out of studying mountains and teaching about them. This lead naturally to focusing on structural and "hardrock" geology, as mountains best expose rock structures and igneous and metamorphic rocks.

Joe Travis Elkins
Hometown – Fort Collins (originally from Athens, GA)
Courses you teach – GEOL 201, SCI 465, STEP 161/262/363
What do you like about teaching? I enjoy demonstrating the relevance of scientific thinking to our society. I particularly enjoy courses that have field components, are hands-on, and interdisciplinary in nature. I like to share with students the question "What is the evidence for…?" I also like driving 15-passenger vans, campfire discussions and cooking out of large woks.
What got you interested in your field of study? Field trips I took in a GEOL 100 class as a college sophomore. I was going to be a sports journalist, but after I went on few geology field trips I thought the stories being told in the rocks and landscape were more interesting than the ones being told on the playing fields. The more time I spent outside, the more I got into geology because it is everywhere.
Hobbies / Interests – I am a whitewater raft guide in the summer and in the winter I try to ski as much as I can on

the weekends. I also like to cook and tinker with junk bicycles. I am also a Georgia Bulldog football fan and an Atlanta Braves baseball fan too.
Anything else you'd like to share about yourself…
Besides geology, I am interested in emergency medicine. I am a wilderness first responder and I enjoy target sports of all types. Using the power of intuition and improvisation to solve problems associated with outdoor living is a lot of fun and I spend as much time as I can with my friends creating mischief out of doors. Currently co-owner/operator of Elkins Distillery in Estes Park. {Hoyt editorial comment: Departmental parties and get-togethers may now include more than just beer}.

Emmett Evanoff
Hometown – Raised in Cheyenne, Wyoming; Undergraduate studies in geology at the University of Wyoming in Laramie; Graduate studies in geology at the University of Colorado Boulder. Currently live in the Peoples Republic of Boulder County.
Interests – Field studies in sedimentary geology and paleontology of ancient river, lake, and wind deposits of the Rocky Mountain basins and Great Plains. Work in the Big Badlands of South Dakota and the badlands of southwest and central Wyoming. In Colorado, I have worked in the Pawnee Buttes area of northeast Colorado, Florissant Fossil Beds, and the dinosaur beds of Cañon City and Dinosaur National Monument.
Courses you teach – Historical Geology, Colorado Geology, Paleontology, Vertebrate Paleontology, Sedimentology & Stratigraphy
What you like about teaching – Having students develop an appreciation of the history of the Earth and a greater understanding of the geology, geologic history, and changes in life seen in the Rocky Mountains, Great Plains, and the Colorado Plateau.
Anything else you'd like to share about yourself…I have been teaching geology classes for 30 years and have over 40 years of field geology experience. I am very familiar with the geology and fossils of the Rocky Mountains, Colorado Plateau, and Great Plains, especially in Colorado and Wyoming.
Like most paleontologists, I became interested in fossils at a young age when I collected my first mammal fossils when I was 12. I worked with geologists and paleontologists as a field assistant between 1970 and 1978 and have been an independent researcher since 1979. Besides teaching, I also worked as a consulting paleontologist for environmental studies of road, powerline and pipeline corridors for 14 years before teaching full-time at UNC.

Kenneth D. Hopkins
Ken, a Minnesota native, completed his undergraduate studies in geology at the University of Minnesota and subsequently earned M.S. and Ph.D. degrees in geology at the University of Washington. Ken joined the Department of Earth Sciences at the University of Northern Colorado (then Colorado State College) in 1969 as an Assistant Professor of Geology. His arrival coincided with the hiring of two other new professors, Dick Dietz (astronomy) and Glen Cobb (meteorology/oceanography) to join with Lee Shropshire to form an expanded department of four faculty. Over the next several years, as the College transitioned to become the University of Northern Colorado, Ken played an important part in planning and developing new programs in geology and meteorology to complement the existing programs in general earth science and earth science teaching, and later a Master's degree program in Earth Sciences. Ken took over teaching the existing Geomorphology course and developed new courses reflecting his specialties, Glacial and Quaternary Geology and Volcanic Geology. These courses together with regular offerings of Physical Geology and General Geology comprised most of his regular teaching responsibilities. Ken's signature course, and the one he most enjoyed teaching, was Glacial and Quaternary Geology. It was one of the department's most popular and featured two field trips. The first was a seven-mile round trip hike to Isabelle Glacier at 11,500 feet in the Indian Peaks Wilderness of the Front Range, a climb Ken made 32 times with his students. The second, a day-long inquiry-based field trip to Boulder Canyon where students, using knowledge gained in class, competed in groups to decipher the glacial history of the valley.
In addition to his regular teaching duties, Ken conducted many summer field courses, mostly in Rocky Mountain National Park, both through UNC and for the Rocky Mountain Nature Association. One of his most memorable field courses was a three-week study tour of the geology of Iceland in 1975 that, together with Lee Shropshire, he developed and co-led. Making it especially memorable is that it occurred during one of Iceland's wettest years in a decade, contributing to the groups' expedition bus partially sinking in a rain-swollen river, and Ken nearly needing a

medevac after developing pneumonia. Fortunately, he recovered in time to finish leading the trip, and all agreed it was a great success.
Ken's research interest focused on reconstructing the record of climate change since the last glacial maximum from geologic evidence, primarily in alpine regions. That interest took him to the Never Summer Mountains bordering the western margin of Rocky Mountain National Park where he had the privilege of mentoring several outstanding graduate students whose thesis research yielded valuable information for this little-known region.
Ken retired officially as a Professor of Geology in 2004 and was awarded Emeritus status but continued to teach his specialty courses and mentor graduate students on a part-time basis. He retired fully in 2012 after 43 years of service to the university.

William Hoyt
Hometown: Winnetka, Illinois
Courses Taught: Oceans and Humans, General Oceanography, Physical and Chemical Oceanography, Geological and Biological Oceanography, Historical Geology, Sedimentology & Stratigraphy, and a large host of MIND and Honors courses, seminars, about 60 topical research projects, 70 master's degrees, and half a dozen doctoral dissertations.
I am a people-person—an extrovert in the modern psychological jargon. It was a rare student I could not grow to like.
Emeritus Professor, Oceanography, Earth and Atmospheric Sciences, Natural and Health Sciences
william.hoyt@unco.edu
970-351-2487; 970-351-4197 (FAX); 970-978-9951 (Cell); Ross Hall 3235H

- Ph.D. University of Delaware, Geology
- M. S. State University of New York at Albany, Marine Geology
- A. B. Middlebury College, Environmental Studies (Geology)

Professional/Academic Experience

- 2013-2018: Earth & Atmospheric Science, Chair
- 2011-2013: School of Earth Sciences & Physics, Director
- 2008-2015: MSP subcontract w/CSU: Pathways, Principal Investigator
- 2007-2010: MSP-CO subcon.w/CSU: Midd. Sch., Principal Investigator
- 2005-2010: GK-12 Track II Front Range Impacts, Principal Investigator
- 2005-2008: School of Chemistry, Earth Sciences and Physics, UNC, Director
- 1999-2005: Earth Sciences Department, Chair
- 1998: Sea Education Association, Chief Scientist

Research/Areas of Interest
A marine geologist and sedimentologist by training, I have continued to be active in studies of coral reefs, both ancient and modern. In more recent years, I have focused my attention on earth systems and science education as it applies to K-12 settings, with grants mostly from NSF, EPA, and the Colorado Department of Education.
Overall in my career, I have been involved in acquiring and administering about $5 million in external grants and contracts. I currently serve as Chair of the Board of Directors of the Poudre Learning Center, Chair of the Friends of Union Colony Schools, and I have been an officer for many state, regional, and national professional organizations.

Gary Huffines
Hometown: Logan, Ohio
Courses you teach: Physical Meteorology (MET 320), Radar Meteorology (MET 465), General Meteorology (MET 205), Our Violent Atmosphere (MET 110), Satellite Meteorology (MET 470), Intro to Weather Analysis (MET 215)
What do you like about teaching? I enjoy working with students and seeing them learn the material. The challenges of keeping up with new material is a little daunting at times, but the challenges are good.
What got you interested in your field of study? I went into the Air Force after graduating with a BA in Physics and thought the military would be a good starting point. They offered me a position in meteorology, and I grew to love it.
Hobbies / Interests: I enjoy listening to audio books, watching TV and movies, reading, riding my motorcycle and traveling. Time with family is always good.
Anything else you'd like to share about yourself: I have been a lot of places and worked with hundreds of people during the 20 years I spent in the Air Force. None of those people are as good as the ones here in Earth Sciences.
Paul Nutter

Hometown – Evans, CO. But, OK, grew up in Beaverton, OR, where I played in the fields and forests that became Nike and Intel world headquarters.
Courses: Dynamic Meteorology and Synoptic Lab. Weather forecasting seminar. Our Violent Atmosphere and General Meteorology. Directed studies/ Internships.
What do I like about teaching?: I've learned that the combination of knowledge and critical thinking is empowering. Therefore, I enjoy seeing the transformation that occurs (the "ah ha" moment) when students learn to think for themselves. It is especially gratifying for me since the vehicle through which learning occurs — weather — is of common daily interest to everyone.
What got me interested in meteorology: I simply have always loved weather, and I'm lucky that nobody ever attempted to dissuade me from pursuing a career in meteorology. Most meteorology majors will understand what I mean, especially those that have temporarily been led down a different path. I remain interested in weather because there is something new to think about every day.
Hobbies: Anything outdoors where I can experience weather; camping, hiking, skiing, running, biking, triathlon. I'm your classic "weekend warrior".
Anything else: No matter what you're doing, it's important to include some laughter.

Cindy Shellito
Hometown – Hollister, CA (No, this is not a beach town, despite what many people believe. This was an agricultural community until recently and is one of at least three cities in California claiming to be the "Earthquake Capitol of the World").
Hobbies / Interests –
I love to travel and hike in far-away and/or remote places. To support my travel addiction, I spend time during my commute learning and practicing new languages. I also enjoy expanding my collection of poorly matched dishes in pottery class, practicing my drawing (whether it's on the white-board in a class of 70 people, or in my travel journal), finding ways to shift my perspective on the world in yoga, and playing with my cats. And, when I have time, I will spend evenings cooking up something new and unusual and edible in the kitchen.
Courses you teach – MET 110 The Violent Atmosphere, MET 205 General Meteorology, MET 260 Mesoscale Meteorology, MET 421/521 Climatology, MET 422/522 Paleoclimatology, MET 495/595 Earth Sciences in Popular Fiction, ESCI 599 Earth Sciences Seminar, ESCI 605 Global Change (online)
What you like about teaching –
Science allows us to see the world in some very new and different ways. I love being able to share my enthusiasm for science and the natural world in the classroom. The best days in the classroom are when I can see that spark of enthusiasm, interest, and understanding in my students.
What got you interested in your field of study -
As a child I loved astronomy, and read everything I could about the solar system, the universe, and space exploration. I wanted to be an astronaut. Later, I learned that there is so much we don't know about our own planet. Earth, alone, would be interesting enough to study for a lifetime. (I also learned that I am horribly prone to motion sickness, and probably would not enjoy flying in space because of it!) I became interested in past climates in high school, when I wrote a report on some new research that implicated an asteroid impact in the destruction of the dinosaurs 65 million years ago. I was hooked on Earth Science. My work in reconstructing Earth's past climate with numerical models evolved from my interests in Earth history, physics, and meteorology.

References Cited {also see faculty books/research articles}

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