The Resource Play and its Connection to WMU

ALSO INSIDE—Faculty and student updates, MGRRE, Michigan Geological Survey, Advisory Council, award recipients, and department publications
The Department of Geological and Environmental Sciences at Western Michigan University has a long history of quality education, research and public service. These achievements have been made possible by our dedicated faculty, staff and students. We continue to grow with an unwavering commitment to succeed and by remembering our past.

Department of Geological and Environmental Sciences updates!

Generous Donation
As a result of a generous gift from a WMU alumni, we are thrilled to announce the establishment of a new donation towards the Schmaltz Museum project in honor of Dr. Lloyd Schmaltz. The funds will also establish a graduate student endowment to support students working towards their M.S. degrees in sedimentology and stratigraphy at MGRRE.

Earth Science Minor Online
Effective spring 2020, the earth science minor will be available online! As an earth science minor, students will learn about the principles of science and how they are applied to the study of the Earth. The earth science minor focuses on a range of fundamental earth systems, including the structure and building blocks of the Earth, the theory of plate tectonics and how studying the Earth allows us to look back through time.

New Courses Offered by Dr. Mine Dogan
New courses being offered in spring 2020!
GEOS 5020 - Computational Methods
GEOS 6500 - Environmental Geophysics

New Instagram Page
Connect with us! #wmugeology
In the Department of Geological and Environmental Sciences...

We offer a variety of academic programs for college students and professionals seeking education in earth sciences, environmental science, resource exploration and recovery. Through our national and international collaborators, the department highly encourages off-campus joint internships and training opportunities for students in diverse, fundamental and applied research fields. Our efforts and the determination of students, have led to the placement of alumni in prestigious national and international institutions. We encourage the enrollment of highly qualified and motivated students and are proud of our alumni who are working in a wide range of geological and environmental sciences professions.

The research facilities of the department are spread across several locations: Rood Hall, Wood Hall and Haenicke Hall on the main campus, and MGRRE, located off-campus. This 27,000 square foot core repository and research center is the largest facility in the Great Lakes area. The Department of Geological and Environmental Sciences also houses the Michigan Geological Survey, which is the official geological resource for the state of Michigan. The department includes 11 active research laboratories, such as earth science remote sensing, stable isotopes and carbonate sedimentology and characterization, all of which are state-of-the-art analytical facilities.
**Letter from the Chair**

Dear friends and alumni,

This has been a good year for the Department of Geological and Environmental Sciences (GES). Over the past 5 years we have been bringing young and energetic faculty on board, Drs. Joyashish Thakurta, Steve Kaczmerek, Matt Reeves, Mine Dogan, Peter Voice, and Andrew Caruthers. The new additions together with our senior faculty, Michelle Kominz, Alan Kehew, RV Krishnamurthy, Dan Cassidy, and Duane Hampton are taking this department to new heights.

Our grant submissions and research dollars peaked this year, 22 proposals were submitted between July 7, 2018 and June 18, 2019. We were the second highest in the College of Arts and Sciences. Last year alone, we secured $1,449,893 in research dollars. Starting spring of 2020, we will offer the Earth Science minor program for the first time as an online program. To the best of my knowledge, this is the first minor in the STEM fields to be offered online at Western. We anticipate that this new offering will be attractive to many students on or off the main campus. We are working hard to make a case for a new major in Environmental Geology this year despite the general reluctance of the higher administration for adding new programs. Our rationale is that Western is one of the very few universities of its size and ranking that do not offer environmental STEM programs and by doing this, the university is losing to the competition, students who are interested in developing careers in the environmental science sectors. We are hopeful we will be able to convince the higher administration the necessity for establishing environmental science programs, and for other STEM units on campus to follow pursuit. In other words, offer similar environmental programs in their areas of specialization, such as environmental engineering, environmental chemistry, or biology. It is only then that Western can claim it is a lead institution in environmental science education.

We are currently advertising for the position of a tenure track faculty specialist position at the Assistant Professor level and expect to finalize the selection by early 2020. This position comes with a heavier teaching and/or service load than the regular tenure track positions. For example, the successful applicant is expected to contribute to the success of MGRRE’s and MGS’s missions. We are excited about filling this position with yet another energetic faculty member who will contribute to the expertise, and vibrancy of the department.

We have made good progress on the project for the renovation and expansion of the Schmaltz Museum. The designs for the Dino Park, which is part of the Schmaltz Museum are complete, the approvals are all in place, bidding for the project will proceed in the upcoming few weeks, and approximately 70% of the required funds for the implementation of the project have been collected. We are shooting for the completion of the Dino Park in summer of 2020. Now that we have the Schmaltz Museum project underway we launched an ambitious initiative to acquire the facility in which the Michigan Geological Survey and the Michigan Repository for Research and Education reside. I am optimistic that we will succeed. My reasoning is that we all, the faculty and staff, the administration of the College of Arts and Sciences, the Advisory Council members, and our alums want to see it happen. A committee from all of the interested parties has been working together to see this project through and I will keep you informed about our progress and will be seeking your help to make this project happen.

MGS and MGRRE faculty and staff are using archived samples and doing field work to find solutions to Lake Michigan bluff erosion and groundwater quality problems. They are also making more data available digitally to support sustainable development of geological resources, including energy and critical minerals. MGS and MGRRE are continuing to seek annual legislative funding to meet the societal needs of Michigan. We all hope that MGS and MGRRE will be successful in securing their resources before you read the next newsletter.

We are fortunate to have alums and advisory council members who continuously support our missions by dedicating their time, efforts, and resources, and by providing advice and advocacy for our initiatives including new programs, projects, and fund raising. We had the largest increase in our endowment base by over $200,000. Dr. Steininger generated an endowment, the Roger and LuAnne Steininger Geology Scholarship, in honor of Dr. Lloyd Schmaltz. An anonymous donor generated a Geosciences Graduate...
Student Scholarship Fund. Mr. James Duncan donated a Rhodocrosite specimen to the Schmaltz museum valued at $80,000. We and our students value these contributions, they create opportunities for our students and help them reach their goals. Every year we celebrate the achievements of one of our alums by selecting him/her for the departmental alumni award. It has always been a difficult task to select only one from the many deserving alums. This year we selected Dr. Thomas Robyn who graduated from the department in 1972 with a B.A. in Geology. He earned his doctorate from the University of Oregon's Center for Volcanology in 1977. As President & CEO and Director of Yorbeau Resources, Dr. Robyn designed and implemented an exploration program that resulted in discovery of two Late Archean lode gold deposits (Cinderella & Lake Gamble) on the Rouyn Property along the Cadillac-Larder Lake Break in the Abitibi region of Quebec.

Our last year departmental awardee, Dr. Roger Steininger, was one of two alums selected this year for the Distinguished Alumni Award. What an honor for us and for him.

I had to take some time off in fall of 2018, but this did not affect the productivity of our research team in the Earth Sciences Remote Sensing facility (ESRS). Two of my students, Esayas Gebremichael and Sita Karki, were awarded their Ph.D.’s. Sita joined the Irish Centre for High End Computing, National University of Ireland, where she works as an Earth Observation Computational Scientist and Esayas accepted a tenure track Assistant Professor position at the Texas Christian University. The ESRS group gave over 20 presentations and published 7 articles last year alone. The articles were published in Science of the Total Environment, Remote Sensing, International Geology Reviews, Earth and Planetary Science Letters (2 articles), J. Hydrology, and in the National Hazards and Earth System Sciences. Currently, the ESRS has ten Ph.D. students (Karem Abdelmohsen, Abdulaziz Aljammaz, Fahad Alshehri, Mustafa Emil, Mohamed Elhebery, Hannah Pankratz, Soha Hassan, Guzalay Sataer, Hossein Sahour, and Moein Izadi) whose Ph.D. research projects are funded by NASA, National Academy of Sciences, the Michigan and Saudi Geological Surveys, the ESRS, and the Egyptian and Saudi cultural affair missions.

I am fortunate to have had the opportunity to work with the faculty, staff, alums, and council members of this department. I worked in many other places before coming here and never did I see such a group of colleagues who care for their work place, treat one another in collegial ways, acknowledge and respect their differences, put the benefit of the place ahead of theirs, and continue to be a part of the GEOS family after they graduate or retire. It has been a rewarding and memorable experience for me and I am sure many of you feel the same.

I want to take the opportunity to thank Dr. Alan Kehew for his significant contributions to our department over the years. Dr. Kehew has taken medical leave for the fall 2019 term, which has been extended through the spring 2020 term. Al is undergoing cancer treatment and we extend our sincere wishes for a successful outcome.

I am looking forward to seeing you all at our spring banquet on Friday, April 17, 2020. Our spring and fall banquets are cherished by all of us, as they provide opportunities to recognize our student’s achievements, meet with you, and get your feedback on our plans. Our students love to hear about your success stories and aspire to follow in your steps.

Mohamed Sultan, Ph.D.
Chair, Department of Geological and Environmental Sciences

DR. WILLIAM SAUCK

Another eventful year has passed since July 31, 2018. Fall semester was my last term teaching in the GES Department: Intro. Geophysics with 12 students and the capable help of TA Karem Abdelmohsen, and Seismic Methods with 8 students. As this was my 5th year of a half-time contract, we were able to again avoid much of the winter by escaping to our Brazil beach home from early January through early March. There we absorbed the sunshine while taking care of flower gardens, coconut, mango, banana, papaya, acerola and a few other fruit trees and shrubs.

On March 11, Tyler Norris defended his M.S. thesis. He was another of Dr. Kehew’s mapping students who used the passive seismic method extensively to map glacial drift thickness in two quadrangles S and SW of Battle Creek. His work was presented at the Eastern Section of GSA and at SAGEEP in Portland, OR, and he quickly found employment at the Ohio Geological Survey.

A few days later we departed for Tucson to stay with some of Kelly’s family who now live there. This also gave me the opportunity to attend a U of AZ alumni gathering to meet some classmates who I had not seen since 1971. One of them was Dr. James Fink (founder of the HydroGEPHYSICS company). I spent a couple days in the field showing him that the Tromino passive seismic instrument could also produce good results in the desert alluvium environment (he promptly ordered one for himself). From Tucson I made a 5-day trip to Portland, OR, to present a paper and Tyler’s poster at the SAGEEP meeting.

We were not home for long before the spring and summer trips to see grandchildren began. We attended 3 weddings and 3 graduations (2 college and 1 HS) at locations between NC and CA. Two of those trips were to MO with our new Chrysler Pacifica. On the first, we took a scoop shovel through the grille on I-80 in mid IL, and the second suffered hail damage in MO. My Buick was not spared, as I hit a piece of pipe on the road near home in July that came up through a rear wheel well and sliced out a big piece of the quarter panel. No claims with our auto insurance company for more than 50 years, and then 3 within 4 months (and lots of new friends at the auto body repair shop)!

With full retirement on April 30, I discovered that Kelly had a long “to-do” list, so now I go to my office about once a week for rest and recuperation. It is good to stay connected with the department and see the changes.
Dr. Bill Sauck is now professor emeritus in the Department of Geological and Environmental Sciences at Western Michigan University. He primarily focuses his research in ground penetrating radar application, electric resistivity and induced polarization, hydrogeology, passive seismic mineral exploration and archaeology.

Sauck spent six years in Brazil working in mineral exploration, groundwater problems and geophysical applications to archaeology in the Amazon region. His work led to the development of the conductive model for Light Non-Aqueous Phase Liquids spills. He has hosted a number of visiting scientists and graduate students from Egypt, traveling six times for groundwater exploration in the western Sinai and Eastern Desert. He has completed archaeological geophysics in Texas, American Samoa, the Yucatan, Brazil, New Mexico, Gotland Island (Sweden) and many sites in Michigan.

Dr. Sauck received the 2019 Distinguished Career Award in recognition of his valuable contributions to the research, education and outreach mission of the Department of Geological and Environmental Sciences throughout his distinguished career.
It’s been another great year here at Kalamazoo/WMU! I am thankful for my excellent colleagues, staff, students, and administrators here at Western, and family and friends. The Hydrogeology Field Course and other courses that I teach have gone very well – please see the HFC update in this newsletter. Apart from graduate student projects, the majority of my research effort over the past year was exerted towards securing extramural funding. I’ve been a Principal Investigator on six proposals since Oct. 2018. One proposal was funded (supports Tanten Buszka as an RA), and decisions are pending on three others. This period of intense grant writing reflected my desire to play a large role in helping with PFAS problem in Michigan and the Nation.

In this capacity, I have become a member of the Michigan PFAS Action Response Team (MPART) Treatment Technology Roundtable, Interstate Technology Regulatory Council (ITRC) PFAS document writing team, submitted congressional testimony on PFAS, and have developed, with input from my colleagues, a white paper outlining the development of a proposed PFAS Analysis and Research Center (PAARC) at WMU. Successful implementation of the PAARC will allow WMU to play a pivotal role in addressing critical knowledge and research gaps on the fate, transport, and remediation of PFAS. Dr. Terri Goss-Kinzy and Jeff Breneman, Vice Presidents of Research and Governmental Affairs, respectively, have been incredibly supportive and instrumental in the development and promotion of these ideas.

The picture on the right is the three of us on Capitol Hill in late June when we met with Senator Debbie Stabenow and Representative Fred Upton and technical staff to Senator Peters and Representative Kildee during a marathon day. We also had a long productive meeting with the U.S. EPA. Our next plans involve meetings with Governor Whitmer’s staff, State Senators, and at least one more trip to Washington, D.C.

Since the last update, both Ryan Cascaran and Clay Joupperi successfully defended their theses on the development of dye tracers for quantification of subsurface chemical residence times and characterization of the Overisel and Salem gas storage fields, respectively. Manuscripts of both projects have been prepared and will be submitted/resubmitted this fall. Clay is employed at EGLE and Ryan accepted a position at TetraTech, and it’s a great feeling to have WMU Alum serving in vital environmental roles in Michigan and surrounding states.

Project-wise, in 2018 I have or am currently working on projects in Florida, Michigan, Nevada, and Togo (Africa). My current graduate students include: Romeo Akara (Ph.D.) characterization of fractured rock aquifers and basin-scale climate change impacts on water resources in Togo using drone imaging, pumping well tests, and integrated surface-groundwater modeling; Tanten Buszka (M.S.) addressing the transport of septic-derived nitrogen into Charlotte Harbor, Florida; Xiang Fan (Ph.D.) theoretical development of the Gaussian dispersion tensor for describing contaminant transport under various symmetric and asymmetric conditions; and Madi Wayt (M.S.) investigating representativeness of hydraulic properties obtained using large displacement pneumatic and physical slugs. Ross Helmer, former HFC grad, will be joining us in fall 2019 to work on a PFAS-related project for his M.S. – please provide him with a warm welcome. I am also working with Tahseen Saeed, Ph.D. Candidate in the Chemistry Department, on reductive defluorination of PFOA which is a destructive method that breaks the carbon-fluorine bond (the 4th strongest bond in chemistry). We are currently writing a manuscript detailing our results.

Finally, that leads me to one of my primary goals of this upcoming year which is to work through my large backlog of unwritten manuscripts that I’ve accumulated on various projects. Chances are that if you see me in my office this fall, that’s what I’ll be working on! 

**Faculty FOCUS** Dr. Matt Reeves joined the department in 2016. Dr. Reeves’ research involves applied and theoretical investigations of fluid flow, heat and solute transport in various types of porous media, with a specialty in fractured rock systems. His research has been applied to various problems, including assessing climate change impacts on water resources, contaminant transport, geological waste disposal, geothermal energy, groundwater-to-surfacewater interaction and hydraulic fracturing for oil and gas.
Hello everyone! Over this past year I have enjoyed another year at Western where I have been expanding my teaching duties while also making strides in research and the Schmaltz Museum. During the fall semester I agreed to teach GEOS 3120 (Geology of National Parks and Monuments) and GEOS 4340 (Problems in Geology), and to also be the interim instructor for GEOS 6010 (Advanced Stratigraphy) and GEOS 1300 (Physical Geology). These courses offer very different areas of focus and their content covers several key concepts in geoscience, necessary for our students to gain a central understanding of Earth Systems Science and the geologic evolution of North America.

This past summer I enjoyed another successful field season in the Wrangell Mountains Alaska. This work is focused on exploring the dynamics of two mass extinction events in the eastern part of the Panthalassic Ocean. I am happy to report a publication for this project early this year in Earth and Planetary Science Letters and several other projected manuscripts that will use data collected from our effort over this past summer.

**Faculty FOCUS**  
Dr. Andrew Caruthers uses a combination of invertebrate paleontology and isotope geochemistry to investigate the effects of paleoclimate change and mass extinction. He has been conducting research in the Cordilleran region of western North America for over 10 years and is specialized in the magnitude and controlling mechanisms of paleoclimate change and mass extinction during the Triassic and Early Jurassic time periods. He has diversified expertise in the following areas: invertebrate taxonomy, biostratigraphy, chemostratigraphy, time scale calibration, terrane paleogeography and mass extinction.
DR. ROBB GILLESPIE

It was another productive year. Two graduate students (with me on their committees) graduated. Tyler Norris did a great job deciphering the glacial complexities of the Sturgis Moraine area near Leroy, Michigan. He mapped subsurface bedrock topography using the "Tromino" and ultimately determined the presence of tunnel valleys in the area. Kevin Rupp investigated sulfide mineral deposits in the Eagle East Mine in the Upper Peninsula of Michigan, and helped advance our understanding of those deposits.

Nate Erber, who graduated with his master’s degree a few years ago after working on a glacial project with Al Keough (I was also on the committee) decided to "re-join" us here at WMU to work on a Ph.D. degree (while he continues working for the State of Michigan). He has begun glacial mapping around Charlotte, Michigan, and has already acquired a new glacial-sediment core. He’s off to a good start.

Andrew Caruthers, the curator of the “Schmaltz Geology Museum” in Rood Hall, has been busy working to reorganize and renovate the museum, and I have been busy working in conjunction with him to build the new Dino Park outdoor exhibit. Last summer, WMU Landscaping relocated two, outdoor art sculptures to other campus locations, cleaned up the gardens and planted a number of ginkgo trees and hundreds of ferns. Three new life-sized dinosaur sculptures were installed (the Stegosaurus, the Utahraptor, and the Triceratops.) Unfortunately, the second Utahraptor was damaged during shipping, and its replacement did not arrive until after winter had set-in making installation impossible. So, the Raptor stood all winter-long in the “Sedimentation Laboratory” looking out the window, watching and patiently waiting for spring. He’ll be attending "Bronco Bash" along with the Geoclub the first week of fall semester (Students can donate a dollar and get a “Selfie with the Raptor.”). Then, he will be joining his twin in Dino-Park.

The next dinosaur, the Parasaurolophus, has been ordered, and the Spinosaurus and Brachiosaurus are next on the list. Construction will begin during spring 2020 on: (1) various geological rock outcrops and structures, (2) the Michigan Basin geological-time-line and mass-extinction displays, and (3) dinosaur trackways (These footprint stepping-stones are expected to go-like-hotcakes, so send in your donation for one today.). These displays will tie directly into geological courses currently offered by the department, and will be used for outdoor “field” exercises to augment the indoor laboratory portion of these courses. “Official Groundbreaking” is planned for fall 2019.

Although the park will always be evolving and improving, all of the six original construction phases are expected to be completed by late fall 2020.

This was the first year for teaching the revamped Geology Field Course. We expanded the course from two, to three weeks, and reorganized it as three separate courses (modules). I developed the new, first-week "Technics" module, and Andrew Caruthers and I co-taught it. It was conducted around the WMU campus and along a cross-section line from Kalamazoo to South Haven. Andrew flew his drone over a series of west Michigan drumlins and along the Lake Michigan bluff failures at Miami Park. He then tied these local Michigan drone exercises to examples of field mapping he is currently conducting in Alaska and Nevada. Exercises varied from the traditional, such as mastering the Brunton Compass, mapping geological structures, and constructing cross-sections, to current, cutting-edge methods such as LiDAR imagery and Geo-apps for student’s i-phones. Things went very well for the “first-time-out.”

I’m still teaching GEOS 1000 “Dynamic Earth,” GEOS 3220 “Ocean Systems” (both classroom and on-line), and GEOS 1500 “Natural Hazards and Disasters.” Publishing companies are merging, and text-books and online homework exercises are undergoing major revisions. We are also transitioning from the WMU “General Education” program to a new, updated program entitled “Western Essential Studies (WES).” It’s all the same, but totally different.

I had three visually impaired students in the GEOS 1000 course this last spring semester, which provided a number of challenges. However, it all went well, and proved to be an interesting and instructive semester for all of us. Looking ahead to the fall 2019 semester, it appears that there will be another three visually impaired students in the course, so I’m sure there will be more to learn.

“Back at home: big storms, big trees down, tennis-ball-sized hail, damaged shingles, high water, stream erosion and more big rocks to move. Be careful what you wish for.”

Robb Gillespie: Dinosaur Park Developer, Park Ranger, and Dino-wrangler

I continue to enjoy my administrative role as an Associate Dean with the College of Arts and Sciences, working on initiatives related to promoting research, fostering graduate education, and enhancing diversity and inclusion across the College. Administrative work leaves little time for other academic pursuits, but I've had the pleasure of directing the Pathways to Science Teaching (wmich.edu/science/pathways) project for the past two years, with one additional year to come. Pathways, funded by the National Science Foundation, seeks to improve the preparation of science teachers at WMU through creation and evaluation of a summer program involving scientific research, teaching preparation, and teaching practice. This project is co-directed by Steve Kaczmarek (Geological & Environmental Sciences), Todd Ellis (Mallinson Institute and Geography), Steve Bertman (Institute of the Environment & Sustainability), and Paul Vellom (Teaching, Learning, and Educational Studies). This summer our second cohort of 8 undergraduates conducted a water quality and benthic macroinvertebrate study along Portage Creek, taught middle school youth in a WMU summer camp, and taught grade 1-5 children at the Kalamazoo Nature Center. Thanks to supplemental grant funding, we took our cohort to present their research and teaching at the 2019 fall AGU meeting in San Francisco.

Continuing in my research group are Ph.D. student Sammy Nyarko, M.S. student Jay Cockrell, and dual M.S.-Ph.D. student Kristen Foley. Sammy is currently working on a study of how future teachers in Ghana understand climate change and ozone depletion. Jay is wrapping up his thesis project in which he pilot-tested 3D printed terrain for use in teaching topographic map skills. Kristen is working on her thesis proposal, which will investigate how virtual field trips are used to teach geosciences.

As a subject, geology has been taught at WMU since the opening of the Normal School in 1904. The instructor of that course, was Leslie H. Wood, in whose honor Wood Hall is named. During the first few years, Wood was the only instructor in the Department of Geography and remained at the fledgling school for many years.
Kevin Rupp completed his research on the “Petrogenesis of the Eagle East Gabbro in Marquette County, Michigan, USA” and graduated with an M.S. degree in spring 2019. He presented his findings in the 2018 Annual Meeting of the Geological Society of America at Indianapolis. Beau Haag is in his second year of the Master’s program and he is working on the textural and isotopic characteristics of sulfide minerals in the Paleoproterozoic Michigamme Formation of the Upper Peninsula of Michigan. He presented his preliminary findings at the 2019 Geological Society of America at Phoenix. I have made a presentation on our continuing work on the sulfur isotope characteristics at the Penokean Volcanic Belt, at the Goldschmidt Conference at Barcelona in 2019.

Three peer reviewed journal articles were published on the research by graduate students Nick Moleski, Ben Hinks, Anthony Boxleiter, Alex Koerber and undergraduate student Katharine Rose.

Undergraduate student, Evangelia Murgia at Giants Causeway in Northern Ireland.

Dr. Joyashish Thakurta is an assistant professor of igneous petrology and economic geology. Thakurta focuses his research on the origin of magmatic intrusive bodies and the occurrences of magmatic and hydrothermal sulfide mineral deposits of base and precious metals associated with such intrusions. He emphasizes the economic importance of Ural-Alaskan type complexes and its origin. He works on the petrogenesis and geochemical characterization of a selected group of Ural-Alaskan type complexes in southeastern Alaska. Thakurta is interested in the metallic sulfide mineral deposits located in the Upper Peninsula of Michigan related to the Penokean orogeny (1.8 Ga) and the magmatic events associated with the formation of the Mid-continent Rift system (1.1 Ga). He is also interested in applications of stable isotope geochemistry in high temperature geological processes. He operates a Delta-V isotope ratio mass-spectrometer in his Economic Geology Laboratory for the collection of stable isotope data.
Good day Everyone! This has been another busy year for me. I continued on as Graduate Advisor, Faculty Teaching Specialist and Director of K-12 Outreach.

The Dinosaur course is still going strong – I am now on the 7th time teaching it – reaching over 650 students! I taught Historical Geology and Structural Geology again. I had one new class – Clastic Depositional Systems, which took up a lot of time. In the fall, I taught Introduction to Soils and Clastic Petrography – two courses that I haven’t taught in a while.

Elizabeth Gaines defended her Honors Thesis on the Amherstburg Formation. She examined and described three cores across the basin and generated a preliminary depositional model for the unit. Ayu Nurhidayati worked with me over the spring and summer on an independent study of the Richfield Member of the Lucas Formation. She focused on the Winterfield Field – a reservoir that had a very productive second life through secondary recovery operations. Her work will be presented at an upcoming Eastern Section of the American Association of Petroleum Geologists Meeting and at a Michigan Basin Geological Society Meeting. I will be taking on my first graduate student this fall – Joe McGuire. Joe comes from Illinois State University. He will likely be continuing the work on the Detroit River Group that Ayu and Elizabeth started.

CoreKids thrived last year – including volunteering at one of the largest events we have ever helped out with – the Metro Detroit Youth Day with over 20,000 children attending. Donations kept the program thriving and allowed us to do about two dozen events reaching close to 40,000 children. I will be taking on the Presidency of the Michigan Earth Science Teachers Association starting in October. I am working with John Yellich, Bill and Linda Harrison, Jennifer Trout and Joyashish Thakurta on a new Survey initiative to gather information on critical mineral deposits in Michigan. My role has mostly been tracking down publications and updating our Geology of Michigan Bibliography. A new edition of the bibliography was published by the survey in January. I also have been working on a basement map for Michigan as part of the project.

I also for once took a vacation – and visited Washington D.C. for the first time for a three-day weekend. I wandered the mall, visited the Lincoln Memorial, the Museum of Natural History, the Botanical Gardens, the National Postal Museum and the National Geographic Museum.

**DID YOU KNOW?**

In 1907, a course called “Minerals and Rocks” was added to the geography curriculum. By 1925, the geography department had grown to four faculty members, and its name had changed to the Department of Geography and Geology. There were three geology courses at that time: 207A-Geographic Geology, 207B-Economic Geology, and 207C-Historical Geology—another course that is still taught. Although the other faculty members occasionally taught a geology course from time to time, the vast majority of geology courses were taught by professor Wood.

**DR. PETER VOICE**

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**Faculty FOCUS** Dr. Dr. Peter Voice is a faculty specialist and teaches earth systems, historical geology, invertebrate paleontology, sedimentology, advanced stratigraphy, geomorphology, mineral deposits and ocean systems. Voice works as a research associate for MGRRE and directing CoreKids. Voice uses numerical and statistical methods to understand large scale patterns in sedimentation. He has conducted research on carbonates and siliciclastics in Michigan and other states. His research interests include quantitative sedimentology and provenance analysis.
The year gone by was very engaging and was made up of diverse activities. Academic activities continued to be rewarding. I designed a new online course called Isotope Hydrology especially for Hydro Certificate program although hydrology and geochemistry majors also benefited from it. Research activities involved doctoral student Shelby Hurst, M.S. student Lincoln Grevengoed, M.A. research student Anita Yuliyanti and undergraduate research student Stephanie Buglione. All of these students worked in Liquid Water Isotope Lab on various projects. Stephanie, a geochemistry major, received the Undergraduate Research Excellence award twice and presented a poster at the AGU meeting in Washington. She also did some projects with NASA which was possible due to her research credentials. Shelby presented a poster at the AGU meeting in Washington. She also received the All University Graduate Teaching Effectiveness Award. Lincoln presented a poster at the Michigan Academy of Sciences meeting and also received a Graduate College Research grant.

I had an opportunity to visit and discuss with the Director of the National Institute for Science Education and Research (NISER) in Bhubaneswar India. NISERS are a counterpart of the celebrated Indian Institutes of Technology (IIT), the difference being NISER focuses on Science and not so much on Technology. These are well founded institutes that attract very bright students. I also had an invitation from United Arab Emirates University in AL Ain to deliver one of their Distinguished Speaker lectures.

As the academic drew to a close, I topped it off by presenting a paper at the prestigious Goldschmidt Conference in Barcelona, Spain. Although I did not get time to do much sightseeing, from whatever I saw, Barcelona must rank among the most beautiful, walker friendly cities of the world. A well-known haven for food, Barcelona boasts of some of the excellent architecture in Europe, highlighted by the famous La Sagrada Familia (Basilica of the Holy Family). I share picture of the glorious window works below.

As a result of a generous gift from WMU, geology alumni Dr. Roger and Mrs. LuAnne Steininger, the Department of Geological and Environmental Sciences is excited to announce the establishment of a new endowed scholarship in their name. Roger and LuAnne have been loyal and dedicated supporters of the department going back to the early 1980’s when Roger began serving on the department’s Advisory Council and have been a tremendous asset to our programs and our students since. They attended the 50th anniversary celebration held in 2015 where he reunited with our founder Dr. Lloyd and Mrs. Marilyn Schmaltz, along with dozens of other loyal departmental alumni, faculty, staff and students. Dr. Steininger has been a frequent visitor to the Department since that event and in 2018 was the recipient of our alumni achievement award because of his significant achievements and contributions in the mineral and mining industries and his long history of support to our department and the greater geological community. As noted by Dr. Steininger, his achievements and success started with the solid geological base supplied by Dr. Schmaltz, and others, in our Department. In honor of Dr. Lloyd Schmaltz, the Roger and LuAnne Steininger Endowed Scholarship is established to assist our upper-level undergraduate students who have a passion for the geosciences and who are in need. Thank you, Dr. and Mrs. Steininger for your generous gift and for your ongoing contributions to student success at WMU.

“Thanks to this gift, many deserving geological and environmental sciences students will be given exceptional educational and research opportunities with faculty,” said Dr. Mohamed Sultan, chair and professor of geological and environmental sciences. “Additionally, the scholarship will help Dr. Schmaltz’s outstanding teaching legacy continue for years to come. The department and University are very grateful to the Steiningers for their longtime support – they are a tremendous asset to our program and students!”

The famous La Sagrada Familia in Barcelona.
Hello again Bronco Geoscientists and friends! Another academic year is in the books, and I’m happy to report that the Carbonate Petrology and Characterization Laboratory (CPCL) is still running smoothly and we’ve continued to make good progress on our research projects in 2018-19. Although the composition of the CPCL has evolved since last year, our team of talented and motivated students continues to show how productive they can be (photo 1). More specifically, we’ve enjoyed a tremendous amount of success this year in terms of publications, graduations, awards, and new arrivals. Here’s a short recap and a few highlights that I’d like to share with you:

Relatively speaking, our fall semester was pretty tame. As per usual, I taught Sedimentation & Stratigraphy, and continued the tradition of taking students on a four-day field trip to Kentucky (photo 2). In November, two CPCL researchers presented papers at the annual GSA conference. Mohammed Al-Musawi (M.S.) gave a talk on his Burnt Bluff chemostratigraphy work, and Mohammed Hashim (Ph.D) presented a poster about his calcite microcrystal synthesis experiments. In December, Brooks Ryan (Ph.D.) had his paper on the Eocene dolomites of Qatar accepted for publication in Sedimentology.

The spring semester, in contrast, was fairly hectic but fun nonetheless. While most Michiganders were hunkered down dealing with the polar vortex in February, Brooks and I were enjoying field work with our collaborators in sunny Qatar (photo 3). Also in February, Zaid Nadhim (M.S.) successfully defended his thesis on the Silurian reefs in Michigan. Shortly thereafter, he departed Kalamazoo for a position at Chesapeake Oil in Oklahoma City. In March, Matt Rine (Ph.D.) finished his dissertation and passed his oral defense. Matt was my first Ph.D. student, so it was a real treat to present him with his doctoral hood during the spring commencement ceremony in late April (photo 4). His paper on using carbon isotope chemostratigraphy to better understand the stratigraphic architecture of the Silurian reefs is currently in review at Paleogeography, Paleoclimatology, and Paleocology. Matt continues to work locally as a geologist for Consumers Energy. Also this spring, we welcomed Zander Sorenson, who joined the CPCL team as an undergraduate researcher. Through his involvement with our various projects, he’s become proficient on the XRD and SEM, and has proven to be a critical asset to the CPCL team.
Although technically my “summer break” — insert wink emoji here - May was an extremely busy month for the team. I continued my involvement with our Pathways to Science Teaching project (for details, see the update from Heather Petcovic). On the research front, Mohammed Al-Musawi (M.S.) defended his thesis in early May, and spent most of the summer months working on a few papers for publication. His first is currently in review in the journal Applied Geochemistry. I’m happy to report that Mohammed will be staying in Kalamazoo for his Ph.D. as I was fortunate enough to convince him to work on an ExxonMobil funded project on the Miocene carbonates in Qatar. In mid-May, the CPCL had another solid showing at the annual AAPG conference in San Antonio, Texas. Brooks Ryan and Mohammed Hashim (Ph.D) delivered superb oral presentations, and Cameron Manche (Ph.D.) and Kat Rose (M.S.) presented impressive posters (photo 5). Also in May, Mohammed Hashim’s extensive review paper on limestone microporosity was accepted for publication in Marine and Petroleum Geology. This is the first in-depth review paper on this topic in over 30 years, and it represents a truly massive accomplishment.

In June, Cameron Manche’s (Ph.D.) project on the Upper Glen Rose Fm. dolomites in Austin, Texas was published and featured on the cover of Geology (photo 6). We are extremely proud of this work. The project started with a GEOS 6650 class trip in the spring of 2017 to collect samples, and it culminated in a high-profile publication. This is a fantastic example of how teaching and research can intersect in a positive and productive way. Cameron is currently working as a post-doctoral researcher at Texas A&M.

This fall, I’m looking forward to bustle of campus as the students return for another academic year, some cooler temperatures, Hanna Cohen’s M.S. thesis defense, and the arrival of our newest team member, Sarah Hayes. Hanna has been teaching high school science in the Chicago area for the past year while finishing her thesis. Sarah comes to us with a B.S. in Chemistry from Oakland University, and we’re truly excited that she’ll be starting her M.S. program this August.

As I hope you can see, the CPCL has much to be thankful for and proud of this year. Of course, there are a million other things that I’d like to talk about (photo 7), but they’ll have to wait for another time.

All the best to you and yours,

Steve K. and the CPCL team

In the 1931-32 academic year, a major transition in geology instruction began as Dr. William J. Berry arrived at the school and Leslie Wood retired at the end of the year. During his tenure, in which he served as chair for many of those years, Berry was the only faculty member who taught geology courses on a regular basis. In the 1939-40 academic year, Geography and Geology 335-Mineralogy, was introduced as a new course.

Dr. Stephen Kaczmarek is an assistant professor of geology and head of the Carbonate Petrology & Characterization Laboratory. His academic interests focus on carbonate diagenesis. He is especially interested in the processes and outcomes associated with dolomitization and calcitization. Much of his research relies on obtaining detailed textural, mineralogical, and geochemical information from natural and laboratory synthesized minerals. To obtain this information, he and his students utilize various analytical instruments, including X-ray diffraction (XRD), X-ray fluorescence spectroscopy (XRF), scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), thin-section petrography (TSP), atomic force microscopy (AFM), and stable isotope (C & O) geochemistry.
In most petroleum-rich basins hydrocarbons are formed in the center of the basin, but a portion migrates updip into conventional traps at shallower depths. The oil and gas generally winds up in excellent quality reservoir rocks, where it can be extracted. Traditionally this is the conventional oil and gas we have found and produced. Advancements in geochemistry have shown us that in most basins only about 10% of the hydrocarbon makes it to these conventional traps, and the remainder is found in ‘permeability jails’, the tight source rocks in the basin interior.

For over 100 years we explored for the 10%, but for the last 15 years we have focused on the other 90%. New techniques and tools have been developed to allow us to change the rules of oil and gas exploration and enter the era of the “Resource Play”. This approach has precipitated a Renaissance for the North American oil and gas industry.

The term Resource Play is used to describe a geologic condition in which the oil and gas source rock is in the same formation as the reservoir rock. Geologists have known about these source/reservoir combinations for many years, but did not consider them to be economic, because the reservoirs were basically impermeable. In other words, the oil was present but you couldn’t get it out.

However, the drilling of horizontal wells, coupled with hydraulic fracturing has allowed these reservoirs to be tapped. Over the last 15 years, this approach has all but replaced the older style of hydrocarbon exploration and has allowed the industry to double the production of oil and gas in North America.

The first oil Resource Play to be discovered and produced is in the Bakken Formation and the second is in the Eagle Ford Formation. Both Plays were discovered and developed by a company called EOG Resources. The connection to Western Michigan University is that the plays were directed by WMU alumni Jim Peterson and Robert Garrison.
THE BAKKEN PLAY
The name Bakken refers to a rock formation in the Williston Basin of North Dakota and Montana which is Upper Devonian to Lower Mississippian in age. Black shales in the Bakken contain very high amounts of organic material and have always been considered world class. But it turns out that most of the oil generated in these shales has stayed right in the Bakken, having moved only a few feet away from the source rocks into the adjacent siltstones and dolomites.

The Bakken can be compared to an Oreo cookie. The chocolate on the top and bottom refers to the two highly-organic shales and the white filling in between is the reservoir. That’s where the horizontal wells are placed. A typical Bakken horizontal well is shown in figure 1.

The #1-36H Parshall well was set up to drill down to the Bakken level at 9000 feet and then drill horizontally 5000 feet in the Middle Bakken. However, after drilling out about 1200 feet horizontally the well encountered very high pressure and could go no further. Nevertheless, the well produced 463 barrels of oil per day.

The initial success spurred on the drilling of several more very prolific wells, and the first successful oil Resource Play was confirmed. At the time, the team knew they had found a large oil field, but they had no idea of the tremendous scope of that field.

The Bakken TOASTY TODAY
Today there are more than 18,000 wells in the Greater Bakken Field. Here is a map of the Bakken’s productive footprint (see figure 2).

Production as of August, 2019 was approximately 1.5 million barrels of oil per day from the North Dakota portion alone. So far about 300 million barrels have been produced from the entire field. The U.S.G.S. assessment of technically recoverable reserves from the Bakken stands at 5 to 10 Billion barrels of oil.

There are many benefits to the economy from the Resource Play “Revolution”. One such benefit is good-paying jobs. Here is a tally for North Dakota showing that some 100,000 people have benefited as a direct result of the Bakken Play.

"They had no idea of the tremendous scope of that field."
By 2015 nearly 1.2 million barrels of oil per day were being produced from the Eagle Ford. As of September 2019, 27,513 wells had been drilled. The U.S.G.S. assessment of technically recoverable reserves from the Eagle Ford stands at 8.5 Billion barrels of oil, 66 Trillion cubic feet of gas and 1.9 Billion barrels of natural gas liquids. Here is a map of the Eagle Ford oil field (see figure 5).

THE EAGLE FORD PLAY
On Sept. 11, 2001, Robert Garrison (B.S., 1974), who at the time was General Manager and SVP for EOG Resources, was on a private jet, flying to a ranch in South Texas owned by independent oil producer Rod Lewis. While in flight, the World Trade Center came under attack. Robert was planning to meet with Rod to discuss the drilling of the first horizontal well in the Eagle Ford. The plane was ordered out of the sky and landed on a private air strip, where together they watched the second tower fall on TV.

With the fall of the towers, neither Robert nor Rod wanted to talk business, and the proposed well now suddenly seemed irrelevant. Both men had full intention of pursuing the Eagle Ford but as fate had it, they went their separate ways. Ultimately EOG Resources became the largest oil producer in the Eagle Ford and Lewis Petroleum Properties became the largest gas producer in the play.

At the time, natural gas was already being produced from hydraulically-fractured horizontal wells in shale formations. It had become clear that gas Resource Plays were going to change everything about the natural gas market. Suddenly there was a 100 year supply of cheap and inexpensive natural gas. The biggest problem was getting it to market. However, this provided a long term solution for power needs for decades and allowed the U.S. to reduce its dependence on dirty coal.

But while gas was easily produced from hydraulically-fractured horizontal wells in shale formations, the prevailing thought was that it was impossible to produce oil from the same rocks. The reason was that “shales” had very small pores, the pore throats were reported to be less than 5 nm, and with oil molecules typically 4 – 20 nm, they were considered too large to flow through pores that small. Oil was being produced out of the Bakken, but it was thought that the dolomite facies with much larger pore throats made it work.

After the discovery of the Bakken, Garrison put together a team to look at the Eagle Ford as a potential oil Resource Play. Through core work, argon ion milling techniques and FESEM, it became obvious that preconceived notions of pore sizes were inaccurate. “Shales” were rarely claystones, but simply fine grained rocks in which pore sizes were a function of mineralogy. It appeared that the Eagle Ford had the potential to flow oil.

THE EAGLE FORD DISCOVERY
In October of 2007 the first leases were identified and purchased in the oil window of the Eagle Ford Formation. In October of 2008, EOG Resources drilled the Tully C. Garner #97H. It had a 3,929 foot lateral with an initial production of 3.4 million cubic feet of gas per day. This well was drilled in the gas window to define rock quality.

The real prize was the oil window. The EOG team was leasing the oil window before and during the drilling of the Tully C. Garner well, trying not to draw attention to what they were doing. They ultimately leased 569,000 acres in the Eagle Ford. The discovery well was the Milton #1H, a horizontal well drilled in 2009 with an initial production of 668 barrels of oil per day from 1800 feet of lateral length.

So not only did EOG drill the first successful wells in the first two oil Resource Plays, the acreage positions they put together catapulted them forward to become the largest oil producer in the lower 48 states.

THE EFFECT ON THE OIL AND GAS INDUSTRY
When these two plays were found, oil production in the United States had been on the decline since the late 1960’s. The major oil companies had all but given up exploring in the U.S. because the fields being discovered were getting ever smaller and the costs were not competitive with foreign opportunities.

The Bakken and Eagle Ford were at the forefront of a revolution in thinking that allowed the U.S. oil companies, in particular the smaller firms, to grow and expand domestic oil production for the first time since the 1960s. ‘Peak Oil’ was proven to be a myth, and future exploration will focus on continued innovation and intestinal fortitude. See figure 6.

The Eagle Ford
TODAY

By 2015 nearly 1.2 million barrels of oil per day were being produced from the Eagle Ford. As of September 2019, 27,513 wells had been drilled. The U.S.G.S. assessment of technically recoverable reserves from the Eagle Ford stands at 8.5 Billion barrels of oil, 66 Trillion cubic feet of gas and 1.9 Billion barrels of natural gas liquids. Here is a map of the Eagle Ford oil field (see figure 5).
The ramifications of the Bakken and Eagle Ford discoveries were world changing. These discoveries set the stage for other oil resource plays. Prior to the discoveries, the price of oil had been increasing and the cost of energy was a strain on the economy. U.S. imports of oil continued to expand, and the economies of the western world were subject to the whims of OPEC.

Today the U.S. produces 12.6 Million barrels of oil per day, and 7.7 Million are from hydraulically fractured horizontal wells. The Bakken and the Eagle Ford account for 21% of the total U.S. oil supply.

Today, due to fracking and oil resource plays we have increased domestic oil production such that the U.S. is now on par with Saudi Arabia and Russia. We have significantly decreased imports and have become a net exporter of crude oil.

The price of oil has fallen dramatically and should remain relatively low for quite some time. The low cost of energy is one of the biggest factors in the economic recovery since the Great Recession. Further, an abundant and stable supply of a rich energy source such as crude oil will allow us to diversify our energy portfolio as a nation into the future, while keeping our economy strong.

In the end, the legacy of WMU’s Geological and Environmental Sciences Department is to have contributed to the strength of the U.S. economy. Both Peterson and Garrison support a continuation of WMU’s involvement in the oil and gas industry, where graduates can have an impact on the fabric of our country.
Dino-Park has taken another significant step forward with Dr. Lloyd Schmaltz donating funding for the life-sized Stegosaurus sculpture. This move allows WMU to not only continue developing Dino Park, but in a broader sense, to continue its strong tradition of leadership developing new educational paradigms and promoting "best practices" pedagogy. The Stegosaurus is just one of the many life-sized dinosaur sculptures planned for Dino Park.

Lloyd Schmaltz was the first chairman of the “Geology Department” when it was first formed, splitting away from Geography in 1965. He nurtured the new department, and during the 1960-70s, was instrumental in helping design Rood Hall when the University decided to house its rapidly expanding science and computer departments in a new, purpose-built building.

His wife Marilyn was always there right beside him, encouraging him, and helping him build the new geology department. Sadly, Marilyn passed away this summer. The new Stegosaurus sculpture in Dino-Park will be dedicated in her honor. Her legacy of helping Lloyd build the geology department, of inspiring and encouraging students, and always helping ensure that funds and facilities were available to those students and faculty that need them, will always be remembered. Dino Park, and the Stegosaurus in particular, will help spark students’ imaginations, and help open their minds to the world of science. Marilyn would love it.
Museum and Park Updates

The department is excited to report significant progress in the development of Dinosaur Park and our continued efforts to renovate the Schmaltz Museum. We received the official approval of space allocation for Dinosaur Park during this past spring and early summer, and we have been working with WMU Facilities Services and a landscape design architect to develop plans for the park layout. This design will incorporate several phases of implementation.

We are excited to break ground this fall or early spring. We have also been working with Facilities Services to renovate mineral cases in the Schmaltz Museum. Currently, we plan to begin the renovation process redoing the large mineral display in the entryway of Rood Hall. This is planned to be completed later this fall. Additional donations will allow us to continue display renovation along the corridor and into the heart of the museum itself. Lastly, we are pleased to announce an article in the September Issue of Encore Magazine that focuses on five displays in the Schmaltz Museum and Dinosaur Park.

Areas where people and businesses can contribute

The department is renovating the Schmaltz Museum of Earth History, and we need your help! We have a number of future displays and exhibits, that will greatly enhance the museum and its learning capabilities within WMU and the greater Kalamazoo community. Project funding is always in need of an assist and we have provided an opportunity whereby donors can purchase a variety of items for the museum and its outdoor interactive entity ‘Dinosaur Park’.

DID YOU KNOW?

Students and faculty worked together to unearth the remains of a mastodon in Van Buren County, MI in 1971. These remains are still housed in the Schmaltz museum in Rood Hall.
We had two excellent summer sessions of the Hydrogeology Field Course (HFC) in 2019! The enrollment was slightly down, but our numbers did not reflect the more drastic enrollment decreases experienced by other field programs across the country. Smaller groups proved beneficial in offering the students a higher-quality field experience with each student receiving more individual attention and having additional responsibility in collection of field measurements, data analysis and interpretation, and report writing than larger groups typically allow.

One of the most unique experiences the HFC provides as an instructor is the opportunity to teach essential field skills to students both internal and external to WMU. This year approximately one-quarter of the students are from Western, with the other three-quarters coming from schools within Michigan and across the Nation. Students in this year’s HFC represented 15 universities across 10 states, including Michigan schools GVSU, MSU, and Wayne State, and out-of-state Universities such as Angelo State, Brigham Young, Appalachian State, Colorado State, Maine, Sonoma State, SUNY, Syracuse, Temple, and Tennessee. New to the HFC this year is our unofficial mascot, Andie, who is Cal Corona’s service dog. Andie brought her joyous enthusiasm to every activity throughout the summer II session!

This update is a reflection of the last three years of the HFC and the changes and evolution the course has undergone during this period. The course text is now the third edition of Groundwater & Wells thanks to Mike Howell of Johnson Screens for providing this exceptional book at cost, a nearly 80% discount! This 800 page text provides unique and extensive coverage of well construction, drilling, and development methods, drilling fluids, well rehabilitation and groundwater pumps – all topics covered in the field course – that are not found in any other text and will benefit HFC graduates throughout their professional career. Tom and I have also changed the schedule by: (1) beginning the 6 week course with Near-Surface Geophysics to allow students to spend their first week in the field, and (2) teaching Drilling prior to Aquifer Testing so students fully understand the anatomy of groundwater wells prior to hydraulic testing.
Each module will be covered sequentially in the order taught. Invaluable contributions from Geological and Environmental Sciences, HFC alumni, and industry partners continue to elevate the course quality and experience to new heights. Each of these folks deserve a personal thank you and it is my hope that this update will at least partially suffice as their roles and contributions to the course are acknowledged – and in some cases – highlighted. These types of updates invoke some risk as there’s a good chance that one or more of our ardent supporters and contributors will be inadvertently left out. If this is the case, please accept my sincere apologies.

I’d like to start by welcoming Mine Dogan who took over the reins from Dale Werkema and taught both sessions of the Near Surface Geophysics module. Dr. Dogan brings to us her excellent technical experience and knowledge, and we’re looking forward to the inclusion of airborne geophysical methods in future courses! The HFC has long been considered one of the points of pride for the Department, and with the new addition of Mine, four of the six modules are now taught by WMU faculty! Dr. Bill Sauck, who has been heavily involved in the HFC since its inception, took time away from his retirement schedule to participate and help with equipment during the Geophysics module.

Dave Stegink aka “Safety Dave” has been teaching the HAZWOPER module since 1986. Dave is a Vice President and Director of Safety for Envirologic Technologies, Inc. Mr. Stegink is responsible for the safety for all personnel at Envirologic which routinely perform investigations at a multitude of contaminated sites and sites with hazardous conditions. This translates into an unparalleled experience for students in learning occupational health and safety from a true expert. A large portion of the HFC’s excellent safety record can be attributed to Dave’s excellent HAZWOPER course, a prerequisite to all of the other HFC modules except Geophysics. We’d also like to acknowledge Envirolec, a long supporter of the HFC and Department, for their generous donation of two Geoprobe direct push drilling and core units – one truck mounted, the other mounted on a modified lawn tractor – and related equipment. The US EPA with the help of Dr. Werkema also donated an older van-mounted Geoprobe unit. Taplin Holdings has also welcomed student tours during the HAZWOPER module for many years that enable students to gain familiarity with various types of heavy equipment used in the environmental field.

The Drilling module has significantly changed under the instruction, experience, and leadership of Tom Howe and Brock Yordy. This is perhaps the most industry-centric module as hands-on operation of a drilling rig is an activity that University Faculty and Staff are generally unqualified to perform. Brock Yordy is an internationally-known drilling instructor and regular contributor to the National Driller, and his positive contributions to the course are a difficult endeavor to put in writing. He has brought national recognition to the HFC through a series of articles that can be found here (https://www.nationaldriller.com/articles/91510-on-tough-drilling-jobs-finding-solutions-is-a-quiz-show), here (https://www.nationaldriller.com/articles/90928-college-solutions-is-a-quiz-show), here (https://www.nationaldriller.com/articles/91295-better-recruitment-onboarding-can-address-drilling-jobs-pipeline), and here (https://www.nationaldriller.com/articles/91525-better-recruitment-onboarding-can-help-fill-drilling-jobs). As a business development manager at Midwest Geothermal, he was able to use Midwest Geothermal drilling rigs during the course and drilled and installed the new pumping well in WMU’s Asylum Lake well field in Spring 2018 – more later. Brock recently accepted a position as the Operation Manager for SUEZ North America, and it is our hope that he can continue to participate in the field course as his demanding schedule allows.

The drilling module has a very dynamic schedule and Tom Howe does an incredible job with last minute scheduling. The drilling of water wells happens when and where they happen, and Tom Howe would like to thank Stock Drilling, Katz WD, Earl Sanders and Sons WD, Stearns Drilling, SME, Cascade, Raymer WD, Foune WD, Dave Bowers and Illinois ASIP Local 150 and many others for their continued support in allowing students on-site access during the drilling, installation, and development of water wells in the local area. Additionally, Western Michigan Drilling, a former subsidiary of Envirologic, has generously participated over many years during both the HAZWOPER and drilling modules by teaching drilling safety, introduction to drilling rigs, and installing monitoring wells. Don Baron, a lifetime supporter of the HFC who recently retired from Johnson Screens, has recently been nominated for a Lifetime Achievement Award from the National Groundwater Association. Chris Bowers (WMU alumni) from Baroid IDP gave an excellent drilling fluids field demonstration which was very well received by our students. Long-time partners Kat WD...
recently were awarded the MGWA Contractor of the year. Other opportunities have been provided to our students from the MGRRE and from the Geotechnical staff at SME. The aquifer testing module still follows the logical progression and format developed by Dr. Duane Hampton since its inception. Many former HFC graduates remember their initiation into the world of aquifer testing through “babysitting” of the pumping test during one of two possible overnight shifts to ensure the pump and generator are working correctly, and collect measurements during both pumping and recovery phases of the test. The duration of the pumping test was reduced from 48 to approximately 28 hours in 2018 to allow for more time in the computer lab to extensively analyze the course-generated pumping and slug test data. This also allows more hands-on time spent learning AQTESOLV, the premiere aquifer test analysis software. Glenn Duffield, president of HydroSolve and developer of AQTESOLV, joined the Summer II course via Skype to provide an unparalleled opportunity to learn various AQTESOLV analysis strategies, tips, and techniques that are unknown to most hydrogeologists. Glenn expressed interest in participating in this role for future HFC sessions and we will continue to foster this new relationship.

Our old Franklin pump, critical to teaching this module, seized in Summer II session of 2017. This was not entirely surprising since past step drawdown tests indicate the well was very inefficient, likely due to screen encrustation.

Costs associated with drilling, installation, casing, screen, pump and controller for a new pumping well are very expensive and the following donations of time, equipment, and money demonstrate the level of commitment of our supporters have for the HFC.

The new pumping well and variable speed controller are ideal for the step drawdown tests and constant rate tests that are routinely performed in the aquifer testing module.

We’d like to acknowledge the donations from the following individuals and companies:

- Brock Yordy and Midwest Geothermal for drilling the new pumping well
- Valley Farm Supply and Shad Teagarden for well casing and materials
- Don Baron and Johnson Screens for a high quality, wire wrapped, stainless steel screen
- Chad Yordy and Baroid Industrial Drilling Products for all drilling fluids and grout
- Greg Parker and Franklin Electric high-end variable speed pump and controller
- Katz Drilling for pump installation and three-phase electrical setup
Two long time contributors to the aquifer testing module are Dan Greene, Senior Hydrogeologist at Fishbeck, Thompson, Carr and Huber, and David Wardwell, WMU alumnus and President of Dune Technologies. Dan Greene has been teaching high quality slug test demos since the inception of the course, and has been a leader in pneumatic slug testing which remains underutilized in the environmental industry. His methods and pneumatic slug testing design are currently being used by graduate student Madi Wayt to investigate representativeness of slug obtained hydraulic properties as compared to pumping test derived estimates.

Dave Wardwell, one of our most prolific contributors to the HFC since 2000, has continued to participate in the field course in teaching the students how pressure transducers work, pressure ranges and accuracy, and navigating the software. Adam Hobson and Nic Panyard (WMU alumnus) from In-Situ were involved in the Summer I aquifer testing module and this resulted in the HFC being recognized in the In-Situ Highlights series: https://in-situ.com/blog/western-michigan-university-hydrogeology-field-course/. In-Situ provides their top of the line equipment vented water level loggers and cables to WMU each summer free of charge. Nic also helped in the design of a newer transducer array configuration that encompasses 12 out of the 14 monitoring wells. Other module changes include Guelph permeameter and double ring infiltrometer demos.

The sampling module has been taught by Dr. Tara Kneeshaw from Grand Valley State University for the last 7 years. Dr. Kneeshaw is an enthusiastic and vibrant teacher who is always popular with the students. Tara is also a great recruiter for the HFC and numbers of GVSU students typically rival those of Western. Dr. Michael Barcelona, WMU Distinguished Professor Emeritus, has introduced many students into the world of low-flow sampling. In addition to aquifer testing, Dave Wardwell participates each year in the sampling module to train students on In-Situ low flow sampling equipment. In fact, this equipment was in the development stage and not yet commercially available my first year of the course. It was remarkable to see this innovative equipment being introduced to the students in a beta testing form, including the smart phone, Bluetooth-enabled software. This equipment makes sampling, including chain of custody and adherence to strict QA-QC guidelines, a breeze. More importantly, the students know how to use this state-of-the-art equipment once they complete the HFC.

Mike Jury of EGLE is a long time contributor and instructs students on how to properly sample contaminated wells, typically at the former Lakeside refinery. Mark Henry continues to teach an excellent demonstration on pore water sampling and quantifying groundwater – surface water interaction, using his innovative Henry samplers. Mark Henry’s ideas and techniques played a central role in Ryan Cascaran’s M.S. thesis research on quantifying residence times in streams. Russell Schindler, SampleServe CEO and WMU Alumni, demos how to use his innovative software and hardware to generate high quality sample labels, including bar codes, for state-of-the-art sample management and chain of custody procedure. Students also got a chance to conduct water and sediment sampling on a world-class research vessel, the DJ Angus, owned and operated by GVSU.

The Remediation module serves as a capstone to the field course and incorporates all of the prior skill sets taught during geophysics, HAZWOPER, drilling, aquifer testing, and sampling which are critical for proper site characterization required for remedial investigations and feasibility studies. Students in the remediation module first learn contaminant fate and transport and
non-aqueous phase liquids – two topics generally reserved for graduate students – and then apply this knowledge to remedial investigations and selection of remedial technologies. These two topics have been added by myself since taking over this module. Students also learn how to conduct Phase I/II Environmental Site Assessments with help from Dave Stegink during HAZWOPER, and Davin Ojala, Brad Masserant, Sara Bals and Casey Smith from SME. Phase I ESAs are another topic that most faculty are not intimately familiar with, and contributions from SME and Stegink to the class are invaluable. John Kern and Jackie Koney of Paper City Development Co. have been of great support to the HFC by allowing us access to the former Vicksburg Mill Site for mock Phase I inspections; and also for drilling monitoring wells during drilling and geophysical surveys. In fact, progress in cleaning up the former mill site has been so significant that it is no longer an ideal place to conduct Phase I investigations. Greg Terrill of Division 5 Metalworks, along with assistance from Dave Stegink and Envirologic, has graciously allowed the class to use their newly acquired Parchment Mill property for the 2019 phase I ESA walk-throughs.

The Remediation module continues to evolve with current industry remediation practices and topics of interest. In 2017, Vapor Intrusion (VI) of volatile organic contaminants was the topic de jour based on new guidelines set by then MI DEQ, now known as EGLE. The emerging contaminant PFAS has dominated discussions of contamination and remediation throughout Michigan since 2018. Both of these topics are valuable to students as VI raises student awareness of contaminant partitioning between aqueous and gaseous phases, and the remediation of PFAS contaminated sites will be the challenge of the next generation of environmental scientists. Brownfield redevelopment is also a hot topic that students are exposed to during the Remediation and HAZWOPER modules. Envirologic led a brownfield tour to two of their sites in 2018.

Field trips and guest lectures by industry experts and environmental regulators are essential portions of this course. David Harn, EGLE has played a pivotal role in teaching students topics including VI, PFAS, site remediation of chlorinated solvents, brownfields and informing students on the roles and responsibilities of environmental regulators. David has graciously donated his time through lectures, followed by an innovative site conceptual model exercise and site tours. This summer he led field trips to the Richland PFAS remediation site, one of the only PFAS sites in Michigan undergoing active remediation.

Diane Russell of the EPA is the other regulator that has played a pivotal role in the remediation module. Through her help and participation since 2017, the course has visited the Kalamazoo river PCB superfund cleanup since near Allegan, Velsicol superfund site, which uses a very interesting combination of in- and ex-situ thermal treatment and dual-phase extraction and an outstanding tour led by Scott Pratt, and the PFAS contaminated Wolverine Worldwide House Street sludge dump located in Belmont. Gaining access to the House Street site, one of the high-profile PFAS contaminated sites in the country, was not easy feat, and we owe a debt of gratitude to Diane, Jeff Kimble of the EPA and Abigail Hendershott, Karen Vorce, and Mark Worrall of MI EGLE. We are also thankful to Wolverine Worldwide and GZA consultants. Karen and Mark, expertly led the House Street sludge dump tour for each of our two sessions.

Other contributors to the Remediation module include Dave Wardwell and Roy Cockwell, Geotech to discuss remediation feasibility studies. In 2018, Wes Wiley of EN Rx introduced their innovate Vertebrae horizontal well network, and Jeff Scieszinski of Vermeer discussed the fine points of horizontal drilling. Ryan Moore from REGENSIS provided phenomenal lectures on REGENSIS and their highly innovative remediation products for each 2019 summer session. This is another new partnership that we are planning on fostering. As a final acknowledgment, the staff at the Kalamazoo waste water treatment facility over the years.

The HFC has generated some good publicity as of late. The class visit to the House Street sludge dump is highlighted by MI EGLE. The multi-well pumping test was featured in In-Situ’s product highlights this summer. In-Situ has also requested us to provide another highlight for the pneumatic slug testing work we are doing, and are planning on using our well field to beta test some of their new equipment this Fall. Several presentations have been made at national conferences by myself and also by Dr. Kneeshaw. Advertising by the Dept. and Extended University Programs for the Certificate Program in Hydrogeology have also been effective in bringing more attention to the HFC.
Lastly but not least, many others are in need of acknowledgment. The first is Tom Howe, who expertly provides daily logistical and technical support to the HFC for an entire 12 weeks which basically encompasses his entire summer!

Directing the best hydrogeology-focused field course in the Nation over two sessions takes an incredible amount of time and dedication, and Tom and I meet at least once a week to work out the logistics of the field course for the upcoming year. Thus, the HFC is a year around endeavor even though it’s typically thought of as a summer activity.

The teaching assistants (TAs) provided much needed support and help with technical field activities, logistical support, van driving, student safety, grading and many other activities. In particular, I’d like to thank Hannah Pankratz and Tanten Buszka for going above and beyond in the Geophysics and Aquifer Testing modules. TAs Karem Abdelmohsen, Romeo Akara, Katie Dvorak, and Madi Wayt were simply outstanding.

As a final thanks, both Tom and I inherited a well-functioning and designed field course from our predecessors: Drs. Bill Sauck, Dale Werkema, Duane Hampton, Al Kelew, Richard Laton, Laura Sherrod, Dick Passero, Mike Durham, Brian Bird and others.

The Hydrogeology Field Course offered by the Department of Geological and Environmental Sciences at Western Michigan University is one of very few hydro-technical programs in the United States. The program, developed in 1987, is directed by Tom Howe and Dr. Matt Reeves. This applied course has trained hundreds of students from around the nation and abroad.

HFC registration summer 2020

The HFC is a series of six one-week modules taught six days per week (Monday through Saturday). The course will be conducted on and near the campus of Western Michigan University in Kalamazoo, Michigan. Each module counts as one semester credit hour and can be taken for either graduate or undergraduate credit. The course emphasizes state-of-the-art techniques for soil and groundwater sampling, aquifer testing, environmental monitoring and the evaluation of groundwater systems.

Course Modules

**WEEK 1**
GEOS 5250—Surface Geophysics
- Session I: May 11-16
- Session II: July 6-11

**WEEK 2**
GEOS 5230—HAZWOPER
- Session I: May 18-21
- Session II: July 13-16

**WEEK 3**
GEOS 5270—Well Drilling Installation
- Session I: May 25-30
- Session II: July 20-25

**WEEK 4**
GEOS 5280—Groundwater Sampling and Monitoring
- Session I: June 1-6
- Session II: July 27-Aug. 1

**WEEK 5**
GEOS 5260—Aquifer Testing
- Session I: June 8-13
- Session II: Aug. 3-8

**WEEK 6**
GEOS 5240—Remediation Design and Implementation
- Session I: June 15-19
- Session II: Aug. 10-14

HFC group picture on the last day of summer II.
Dr. Thomas Robyn was selected for the Alumni Achievement award by the Department of Geological and Environmental Sciences because of his distinguished career and significant work in the field of exploration geology.

Dr. Robyn graduated from the WMU in 1972 with a B.A. in Geology. He earned his Ph.D. at the University of Oregon’s Center for Volcanology in 1977, based on his study of calc-alkaline volcanic rocks not associated with subduction in northeastern Oregon.

After graduation, he joined Anaconda Minerals Company where he explored for uranium deposits in the western US, Africa, South America and Australia. He was based in Oslo, Norway as Regional Exploration Manager, when the Company was wiped out in 1986 by its parent company, Atlantic Richfield Company. He became a consultant, designing and managing exploration projects on several continents for precious metals, base metals and ferroalloys for a wide range of client companies. He held positions as Chief Operations Officer at a gold mine in Ecuador, President of junior exploration companies, and Board Member of an intermediate mining company. Major areas of work include Greenland, Mexico, Norway, Ecuador, Peru and Australia.

Dr. Robyn’s career includes discovery of gold deposits in Quebec and base metal deposits in Mexico and Peru, as well as guiding a junior exploration company, as President and Executive Chairman, to become a mid-sized mining company and transitioning to Senior Vice President, Exploration, as the company grew beyond exploration to production. Dr. Robyn retired in 2015 and now resides with his wife, Mary, outside Denver, Colorado.

In 1987, Dr. Roger Steininger formed his own consulting company to focus on exploration in geologic terrains having gold and other precious metals. His distinguished career has noted his association with, and personal discovery of, numerous mineral deposits including the 20+ million-ounce Pipeline gold deposit in Nevada. For the next 20 years, Dr. Steininger used his knowledge of geology and mineral deposits to develop and establish commercial gold deposits. In 2009, Dr. Steininger co-founded NuLegacy Gold Corporation, a leading gold exploration company, and retired in 2018 after discovering the Iceberg gold deposit in Nevada.

Dr. Steininger has long supported the department of Geological and Environmental Sciences at WMU, first serving on the initial Geologic Department Advisory Council in the 1980s. In addition, he’s made presentations for the department, and guided and hired a number of geology students. After attending the department’s 50th anniversary in 2014, Dr. Steininger has been a frequent visitor to the department.

In 2018, Dr. Steininger received the WMU College of Arts and Sciences Alumni Achievement award for the Department of Geological and Environmental Sciences. He is also the recipient of the 2016 Honored Alumnus Award from the Warner College of Natural Resources, Colorado State University. As noted by Dr. Steininger, these achievements started with the solid geological base supplied by Dr. Lloyd Schmaltz, and others, in the Department of Geological and Environmental Sciences Department.

Roger is now dedicating his time to writing and publishing a summary of the geologic setting for gold and molybdenum prospects and deposits in the Western Cordilleran from Mexico to Alaska. Roger and his wife, LuAnne, reside in Reno, Nevada where they have a son and daughter, their spouses and 4 grandchildren.
CoreKids, the K-12 Outreach Program for the Survey, MGRRE and the department, had another great year—we conducted fewer events, but worked with more than 30,000 students, teachers and parents. We participated in one of the largest events that CoreKids has ever worked with – the Metro Detroit Youth Day, which had over 20,000 children visit Belle Isle for a day of college showcases and other activities.

Last spring, Lisa Anderson and I co-chaired a session on K-12 outreach at North-Central GSA. We had a variety of talks on outreach activities across the Midwest and Plains States. I presented two talks – including an introduction to our Dinosaur Park as well as a history of the CoreKids Program. The History presentation benefited from the memories and documents provided by Sue and Mike Grammer, Bill and Linda Harrison, and Heather Petcovic. CoreKids has worked with over 100,000 children and teachers over the past 12 years!

I was elected as the President Elect for the Michigan Earth Science Teachers Association last August, and as I write this newsletter, I am preparing to take the reins of the organization in October, 2019.

We have a busy fall planned – with events at the Central Michigan Mineral and Lapidary Show, Spooky Science Saturday at the Kingman Museum, Fossil Day at the MSU Museum of Science and MI CareerQuest Southwest. The continued support of the alumni for this critical outreach platform is greatly appreciated.
“As we write this newsletter, we think of the many talented students and dedicated professionals that we have been privileged to work with since we started the old Core Lab in 1983. We are grateful that you continue to think of us and to support us. So, we want to give you an update about our activities this past year—because you played a major role in making them possible.”

—Michigan Geological Repository for Research and Education
Michigan Geological Repository for Research and Education

INDUSTRY OUTREACH AND WORKSHOPS
We welcomed industry and academic visitors who searched for geologic samples and data to support their mapping and research related to Basin geologic history, assessment of oil, gas, and minerals resources, and environmental issues such as waste disposal.

Jon Garrett (left) and Matt Rine (right), Consumers Energy geologists and WMU alumni, examine core at MGRRE for natural gas storage applications.

We hosted two in-house Petroleum Technology Transfer Council (PTTC) gas storage workshops presented by Brock Engineering.

In April we held our spring PTTC workshop, partnering again with Michigan Oil and Gas Association’s (MOGA) annual Petroleum Conference at the Grand Traverse Resort. Almost 200 people attended the PTTC workshop, supported through sponsorships by 21 oil and gas companies and MOGA. Members of industry, government, and academia presented information about field redevelopment opportunities.

We honored Harold (Hal) Fitch, out-going State Geologist, with MGRRE’s 2019 Lifetime Achievement Award. The incoming State Geologist, Adam Wygant, addressed the joint lunch attended by 300 people. After the podium presentations, Autumn Haagsma, Research Geoscientist, Battelle Memorial Institute; Ayu Nurhidayati, WMU graduate student; and Matthew Rine and Jon Garrett, geologists, Consumers Energy presented research posters and shared cores for examination.

Dave Westjohn (left) works with Bill Harrison (center) and Jenny Trout (right) on a StateMap project.

Michigan Potash Company President Ted Pagano (leftmost) and associates examine potash samples and data at MGRRE.

Presenters Tim Brock (left) and Doug Elenbaas (right) at the September 2018 PTTC Gas Storage School at MGRRE

REPORTS AND PRESENTATIONS
Bill Harrison and Peter Voice used MGRRE’s most recently acquired cores to revise the outdated bedrock map of Wayne County and to assess its subsurface resources, risks, and structures. They presented their work, funded by a USGS STATEMAP grant, at GSA, MBGS, and MI-AIPG meetings.

Graduate students Mohammed Al Musawi and Zaid Nadhim presented research on Burnt Bluff and Niagaran formations respectively at the GSA national meeting last fall.

Bill Harrison presented a yearly summary of his CO2EOR research to the November partners’ meeting of the Midwest Regional Carbon Sequestration Partnership (MRCSP) in Annapolis, Maryland. Over 75 months, the Michigan Basin Development Project has stored 1,350,342 tons of carbon dioxide and monitored the production of 986,065 barrels of oil. That has produced 450 jobs yielding more than $19M in income, $65.5M goods and services, and $7.5M in other taxes and royalties.

Bill PTTC speakers (top left to right) Peter Voice, Tim Brock, Robert Mannes, Neeraj Gupta, Ken Prior (middle left to right) and Jon Garrett, Harry Faulkner, Jac Lentz, Hal Fitch, and Bill Harrison (bottom left) Adam Wygant and the group at lunch

Wayne Country Bedrock Geologic Map

Wayne County Bedrock Geologic Map

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Student Morgan Schrom works at MGRRE to preserve cuttings.

Bill Harrison with a potash core is shown on the USGS website as an example of a preservation success story.

**THREE NEWLY FUNDED RESEARCH PROJECTS**

1. A project to preserve a legacy collection of drill cuttings—for our current grant from the USGS National Geological and Geophysical Data Preservation Program (NGGDPP), we completed the first year of a two-year project involving 1,000 wells. Bill Harrison directs the project. Jenny Trout and Linda Harrison work with a team of students to identify the wells accurately, inventory thousands of glass vials of samples, rebox materials, and archive the collection. These samples represent our two major freshwater aquifers, aggregate materials, and other natural deposits, so we are paying attention to detail in preserving these samples. We are honored that the USGS NGGDPP chose to show our proposal on its website as the sample preservation proposal. The website also spotlighted our potash core research as a preservation success story, along with an article about our work to preserve this world-class source of a critical mineral.

2. Bill Harrison directs this latest research project, funded by the USGS, and is joined by Peter Voice, John Yellich and Joyashish Thakurta with a team of students who will search Michigan for 35 minerals and rare earth elements. These are defined by the Department of the Interior as critical to America’s economy and security because we currently import 90-100% of these materials. Cores and data about the potash deposit are essential to this project because potash is one of these critical minerals.

3. Bill Harrison will shortly embark on a recently funded DOE research project, led by Battelle, along with industry partners Innova Exploration, Inc., Meridian Production Services, and Core Energy, LLC. The new project aims at developing enhanced oil recovery technologies and processes for use in complex, multi-porosity and/or hydrothermally altered dolomite reservoirs along fault systems in southern Michigan. He will work with Peter Voice and Jenny Trout on this multi-year project.
REPOSITORY SAMPLE AND DATA DONATIONS
We are grateful to have received some very large donations of cores, cuttings, logs, well records, maps and data from: NETL (CT scans of the Charlton 4-30); the Michigan Department of Transportation (cores from road projects); the Michigan EGLE (12 pallets of maps, mineral well files and geological reports); MOGA (well files including scout tickets); Lansing Community College (mineral collection); and these industry members: West Bay Exploration (cuttings); Miller Energy Company (well logs and data); Core Energy, LLC. (cuttings and 5 pallets of cores); Maverick Brothers Resources (cuttings); and Whiting Petroleum (8 pallets of cores). Jenny Trout and the students are working to inventory and curate these large collections.

STUDENT RESEARCH AND OUTREACH
Peter Voice and Bill Harrison supervised graduate student thesis research for Clay Joupperi, Austin Johnson, Jack Hybza, Matt Rine and Cameron Manche, Mohammed Al Musawi and Zaid Nadhim. They all successfully completed their degrees. Peter and Bill also supervised an undergraduate thesis project for Elizabeth Gaines.

Department students in hydrogeology, geology field camp, and advanced stratigraphy classes visited MGRRE and completed several lab exercises.

We welcomed visiting geology classes from Hope College, Calvin College, CMU, MSU, and GVSU who examined and described cores as part of their coursework.

Graduate students and faculty members from Auburn University, MSU and Grand Valley State University examined cores and samples for their research.

Peter Voice continues to lead CoreKids, the K-12 outreach program. You can read his faculty page for a full update of his new teaching activities.

Once again we ask for your help in contacting your legislators to ask for their support for on-going funding of our work at MGGRE and the Survey. More than half the cores, samples and data that we archive here were acquired since we became part of the Michigan Geological Survey—so those materials actually belong to the State and benefit all its citizens. We need funding from all our citizens to keep these irreplaceable geological records for use by this generation and more to come.

Dr. Rachael Agardy, conducts core exercise at MGRRE with her CMU students.
Greetings Alumni and friends from the Director of the Michigan Geological Survey.

The Michigan Geological Survey (MGS) received the June 2016 funding ($500k) to propose and successfully complete a number of projects/tasks, as reported last year. MGS petitioned legislators in the spring 2018 and received an additional funding of $500k to support a validated geologic understanding in all priority areas, including those areas impacted by PFASs, an emerging contaminant to support MGS until June 2020. This funding allowed MGS to continue to support Michigan geologic studies and research.

The primary functions mandated by the 2011 legislation that created the MGS at WMU includes the investigation of the geological resources of the state, the collection and archival of samples, cores, cuttings, and records of geological investigations and studies in the state. MGS is presenting the case to be the “go to” geological expert for the State of Michigan. MGS believes it has demonstrated the justification for annual funding to be provided by the Legislature and Governor’s office. The completed research has presented a scientific approach to validated geological science to the public and to 21st century users.

MGS has met the mandate through WMU faculty, contracting and supporting WMU students in their research goals, many of the students leaving to earn positions of stature in the geological community of surveys, teaching, industry and research positions in the US and abroad. The MGS primary mission mandates to continue to support the Michigan applied research and investigations. MGS will continue to identify students that MGS projects can support their training and degree that can earn a professional position with government, academia or industry.

October 2019, MGS and the Michigan Department of Environment, Great Lakes, Energy (EGLE), Water Resource Division (WRD), Michigan PFAS Action Response Team (MPART) and the Michigan Aggregate Association have discussed and shared county priority areas for a greater understanding of the subsurface geology. This is a first step to MGS and state organizations supporting a common goal for a greater understanding of water and our natural resources by geographic area. Further discussions with other policy groups will occur over the next few months to have a consensus of need for geological science by county.
The Michigan Geological Survey is to facilitate basic and applied geological research to promote the best use of Michigan’s geological resources for their social and economic benefits, while protecting associated resource values and the environment.

MGS has had 53 “formal” PPT or paper summary presentations during meetings, conferences and discussions during the last four quarters (Q4-2018 and Q1, Q2, Q3-2019) to present the case for more geological science needed for the sustainability of the Michigan natural resources, the MGS mission.

The lack of annual funding prevents MGS from building a qualified full time technical staff to support a continuum of geological science for Michigan and to apply for increased federal grants that require 1:1 cost share. Michigan is lacking in substantive geologic data in many areas including those areas to provide the geologic data to adequately track water quantity and quality and where contaminants are moving in the subsurface groundwater regime. MGS will continue to focus on geological data acquisition and mapping for a greater understanding of critical water resource areas. MGS will provide selective research studies to support the Survey data needs through ongoing USGS mapping, MGS funded projects, and the research programs associated with the MGRRE - Repository, outreach - CoreKids, and utilizing incremental M.S. and Ph.D. student research projects that can support these data voids.

The Michigan State Geologist position transitioned this year with the retirement of Hal Fitch after 43 years with the State and the last 23 years as State Geologist. Adam Wygant has been with the State for 9 years and is now with the EGLE Office of Oil, Gas and Minerals, Division Director, has been named the new State Geologist. MGS wishes Hal all the best as he enters his new life as a consultant.

MGS Director, John Yellich has been elected President-Elect of the Association of State Geologists (AASG) and has assumed a greater role in seeking continued, and increased, federal support for mapping projects for all State geological surveys. Yellich was in DC in March and met with Dr. James Reilly, Director of the US Geological Survey and other USGS Mission directors. MGS and other State Geologists presented the case for more Federal funding for geological mapping throughout the U.S. and in Michigan.

MGS mapping programs are needed to fortify our Michigan’s geologic data package. MGS can provide specific examples of where Michigan has not committed monies needed to present real science associated with the various geologic environments of the State. Additionally, examples of areas where Michigan has been using non-factual or flawed data to support environmental and social decisions concerning water resources. Michigan’s lack of validated scientific geologic data will result in increased cost and time to adequately quantify water resources to determine where groundwater is flowing, and where any contaminants will impact the citizens of Michigan. MGS is also supporting the Ottawa County Planning and Development Department in implementing a water resource program that includes identification, conservation, protection, and artificial recharging of the limited fresh water resources that are available to the fastest growing region in Michigan.

MGS and Ottawa County have been featured on a PBS-WGVU show, Great Lakes. We present the case for a greater understanding of Michigan water resources and the need to focus on sustainable use and conservation of the water resources for future generations. Follow the link to the Michigan Geological Survey: wmich.edu/geologysurvey and look under “News”.

Following is a brief summary of this past year’s geologic developments and accomplishments in pursuit of annual funding from the Michigan Legislature. Michigan has not conducted broad, natural resource research projects for more than 35 years, only incremental data compilation projects. The earlier and current legislative one-time grants have allowed MGS to continue to provide geologic data and programs which have permitted MGS to initiate demonstration studies and programs that would be provided by a fully funded survey. A funded survey would support the societal and economic benefits and sustainable environmental protection of our water and other natural resources for local, county, and state initiatives, plus funded research for WMU faculty and students. More specific external beneficiaries are individuals, industry, city and county planning departments, health departments and commissioners, and the Michigan Departments of Environment, Great Lakes and Energy (EGLE), Natural Resources (DNR), Agriculture and Resource Development (MDARD), and Transportation (MDOT).
MGS continues to operate on “soft” money from Federal and State grants, and until there is an annual budget, MGS cannot hire permanent full time staff to meet continuous mandated geological investigations, nor can it receive an increase in cost share matching Federal funds for mapping programs.

From July 1, 2018 to Sept. 30, 2019, MGS has been granted funds from the USGS, MDEQ/EGLE, MDOT and the Michigan Legislature (USGS - $76,259, $89,835, $99,908 EGLE - $500,000, $300,000, MDOT - 15,000, Legislature - $500,000), respectively, for a total of $1,581,002 to be used for the period July 1, 2018 to Dec. 31, 2020. This does not include the MGRRE grants totaling more than $170,000 in new grants. Please see our website wmich.edu/geologysurvey for a summary of the Department of Geological and Environmental Sciences (GES) resource centers to understand our capabilities, and see a list of those faculty scientists who are partnering their support to the MGS, as well as other resources enumerated in this GES newsletter.

MGS, WMU and student research
MGS at WMU is the primary seed for Michigan geological applied research supported by MGRRE and the WMU faculty, staff and students. MGS has provided a summary of some recent examples of those training and research efforts that have benefited WMU students and Michigan, greater Kalamazoo region, WMU, GES and MGS in the last year. The projects involved (Remote Sensing, ArcGIS, LiDAR, field methods and computer and data analysis) have resulted in graduate degrees and professional positions. MGS is also reaching out to other Michigan institutions to identify how MGS research can support training of future geoscientists in proximity to their respective institutions and that can support mapping critical and priority issues in Michigan.

Remote sensing interferometry
Esayas Gebremichael supported the Interferometry data compilation for the Qatar project (WMU Remotes Sensing and MGS) assessing subsidence in the country and the subsequent training of the Qatar staff at WMU. His dissertation evaluated subsidence in the Nile Delta. Esayas has accepted a tenure track position at Texas Christian University.

ArcGIS methods and training
Sita Karki supported MGS for 4 years as the MGS ArcGIS coordinator. Sita trained many students in GIS applications for their research data, while she entered and received her Ph.D. and published research on monitoring algal plumes in Florida. Sita is now employed as a GIS Computational Scientist at the Irish Centre for High End Computing at the National University of Ireland in Galway through the European Union, in Dublin, Ireland.

ArcGIS, geophysical methods and field mapping
At the suggestion of MGS, Karl Backhaus and Ben Seiderman (M.S. candidates) with support from Sita Karki (Ph.D. candidate) took the initiative and announced an ArcGIS training program. What resulted were multiple night GIS training sessions to students and local geoscientists (~25 per session), presenting the benefits to graduate and undergraduate students and local professionals, an understanding of ArcGIS data presentation principals and how they will be a benefit to your research and for employment. Ben Seiderman is currently employed by Zong Geophysical-Reno, NV.

LiDAR, Tromino, field mapping: USGS EdMap grant
Karl Backhaus, an M.S. candidate applied for and received a USGS - EDMAP grant and conducted field mapping and compilation using field measurements with Tromino-passive seismic, LiDAR interpretations, site sample augering and mapping with the compilation of his data into two USGS quadrangles (>80 sq mi) in Branch County, meeting MGS mapping requirements, which were than published by MGS. Karl is now employed as a geologist with the New York Geological Survey.

Data management groundwater
Clay Joupperi (M.S. graduate) worked on groundwater data for MGS and coupled this with his M.S. project of Michigan Basin Paleozoic fracture systems. Clay is now employed by the Michigan Department of Environment, Great Lakes and Energy (EGLE) in the Water Resource Division.

Tromino-passive seismic and shallow seismic methods to map shallow bedrock valleys
Tyler Norris received partial funding from a MGS grant and conducted and analyzed a demonstration program of comparing Tromino- passive seismic data with the receipt of donated energy industry seismic data. Tyler mapped an area of Calhoun County to confirm the benefits of the Tromino and the locating
and mapping bedrock valleys, potential areas for significant groundwater resources. The Michigan Oil and Gas Association presented in their monthly magazine an endorsement of this collaboration of industry, MGS and WMU research. Tyler was also involved with drilling confirmatory holes in the area of research. Tyler is currently employed with the Ohio Geological Survey as a field mapping geologist.

**Project support and learning methods**

Mohammed Al Musawi has been supporting MGS drilling programs and data review for MGS mapping projects and has presented his M.S. project at GSA. Mohamed completed his M.S. and is now positioned in a Ph.D. program at WMU.

**Data and projects**

One of the primary remote sensing data tools is Light Detection and Ranging (LiDAR) which provides the strategic benefit of a more rapid assessment of surface features. LiDAR is now a foundational mapping tool for geologic projects, which until the last 5 years, Michigan had been lagging the adjoining states. MGS lobbied with the State EGLE, MDARD, and DTMB as well as the Natural Resource Conservation Service (NRCS) of the US Department of Agriculture to continue the expansion of LiDAR acquisition during the past few years and Michigan is now close to having 80% LiDAR coverage.

The Great Lakes are now having the highest lake levels since the 1980’s, nearly forty years. WMU had studied the Great Lakes shorelines in the late 1990’s to mid-2008 (Dr. Ron Chase and Dr. Alan Kehew), for more than fifteen years in areas being impacted by residential and business development and by changes in lake levels. Federal agencies have not been committed to any programed study of Great Lakes shorelines. Michigan alone, more than any other state, has in excess of 3,126 miles of Great Lakes shorelines. MGS presented a case for Lake Michigan studies in 2017, in collaboration with the Illinois State Geological Survey and the Indiana Geological and Water Survey to the USGS, NOAA, and the US Corps of Engineers. A resulting benefit of the discussions and meetings is a proposed collaborative 10 year research program being outlined by the USGS FEDMAP program, which will evaluate the Lake Michigan Basin nearshore geology and the associated shorelines. MGS, and the Illinois, Indiana, and Wisconsin geological surveys will develop an evaluation program to assess the near shore geology utilizing 3D mapping techniques using Remote Sensing and field measurements. Compilations will review the shoreline’s geology and attempt to quantify geology’s response to natural and anthropogenic activities and changes using these remote sensing and field mapping functions. Michigan shorelines have been selected as the initial demonstration locations for Remote Sensing methods and field research with USGS. MGS, USGS and graduate students began late this summer and this is proceeding with all parties soliciting some form of federal, state or local funding support for this research effort.

MGS endorsed the USGS demonstration airborne aeromagnetic geophysical survey in a portion of the UP. This airborne was completed in Aug. 2018. Scientific data was compiled by the USGS and with endorsement from MGS, this compilation will present validated subsurface geological data for an area not previously published at this level of detail. MGS proposed a research study to the 2019 USGS Critical Minerals programs, Earth MRI, and won a $99,908 for a 2 year grant to conduct surface mapping and integration utilizing the new aeromagnetic and LiDAR data collaborating through a MoU with Michigan Technological University (MTU), the Department of Geological and Mining Engineering and Science. This mapping program will support the use of the new USGS aeromagnetic data compilation and LiDAR data with a field confirmation of geology and rock structural controls, a demonstration. This is in an area north of Menominee, Michigan.

MGS appreciates the continued support from the Associations and members of the Michigan Oil and Gas Association, the Michigan Aggregates Association, the Michigan Manufacturers Association and its sub-committees of Environment and Mining, Michigan Groundwater Association, the Michigan Association of Professional Landmen, the Ottawa County Road Commission and Ottawa County Planning Department, the Southwest Michigan Water Resource Council, the American Institute of Professional Geologists and with industries and other agencies and organizations not specifically named here and those individuals who signed the letter of funding support for the MGS.

**Michigan Geological Repository for Research and Education**

MGRRE continues to be the geologic research foundation of the Michigan Geologic Survey through its workshops and research conducted in collaboration with USGS, DOE, industry, faculty and students. Specifics of the 2018-19 accomplishments are summarized in the MGRRE section of this newsletter. Any State funding for MGS is coupled with the ability to maintain the core repository, and the research it offers, that has directly resulted in economic benefits to the State of Michigan. Michigan has received tens of millions of dollars in energy related tax and royalty revenues averaged over the last 30 years, that is a direct result of MGRRE research and programs, yet Michigan has not provided any annual funding for this research and sample storage facility. Nearly 30% of the samples at MGRRE are from Michigan State lands, which has also resulted in specific state revenues. Lastly, since 2011, when MGS was assigned to WMU, more than half of the MGRRE cores have been received from various facilities that no longer wanted to maintain this invaluable rock and sample data. This is Michigan core, and no state funding has been allocated. Local citizens and professionals are requested to contact your legislators to both remind and request annual funding for MGS/MGRRE, a resource for assessing and sustainably managing our natural resources.

WMU and MGRRE have a number of professional presentations and publications associated with this facility, staff, and student research and they are listed in this newsletter for 2018-19.

**CoreKids K-12 outreach program**

Geology outreach is the foundation for education of what geology and natural resources mean to our society, and how they relate to our geologic setting in Michigan. The CoreKids program is the outreach component of the MGS, MGRRE and WMU Department of GES. Dr. Peter Voice has been the coordinator of this program for the last 6 of the over 17
Groundwater is flowing, because most technical experts cannot say where the groundwater is flowing, because most of the subsurface geology has not been compiled and mapped in sufficient detail and consistency to predict, direction and rate of flow, further evidence of the continuous lack of focus on geology. It would be relatively useless to show a map having PFAS locations, because the number and locations will change tomorrow.

MGS has briefly summarized the natural resources by geology and geographic areas and where Michigan has and where we do not have data on the subsurface geology and the location(s) of the supporting data.

The mapping products produced by MGS through the NCGMP Federal matching funds program has increased in the last 6 years because of the additional incremental funding provided from 2012 to present. MGS produced eight (8) quadrangle maps in 2018, and will publish 2 more Cass County quadrangles plus an updated bedrock map for the City of Jackson in 2019. The Cass County mapping products have been recognized by the Michigan EGLE Water Resource Division (EGLE-WRD), Michigan Department of Agriculture and Rural Development (MDARD), and Michigan Farm Bureau (MFB) as a significant contribution to understanding and managing the water resources of Cass County. This recent mapping program has validated geologic data in Cass County which presents additional glacial sediments (over 240 feet below existing data) that can support water resources in Cass County. This regional data has never been published or presented prior to this multi-year mapping project.

Investigation and mapping today is of much greater value because classic “boots on the ground” is still required to confirm the validity of all mapping information, and this also includes remote sensing data. The geologic data available today includes, but is not limited to, the following: subsurface drilling (wireline core, rotosonic core, and Geoprobe), historic drill hole and water well validation and analysis, and remote sensing data. The geologic data in Cass County which presents additional glacial sediments (over 240 feet below existing data) that can support water resources in Cass County. This regional data has never been published or presented prior to this multi-year mapping project.

Michigan has over 4.6 million acres of State land, and for the last 30 plus years has not invested state funds to determine the natural geologic conditions or the basic asset value of any currently owned, purchased or sold State land. The DNR program, as administered, requires any land transactions must be supported by private studies which are not public, and if they were submitted to the State a freedom of information request (FOIA) must be made, negating any open file value to this report.

Michigan must invest in science ~4.6 MILLION ACRES
most recently combining quality LiDAR data for quantifying the surface type, then depth and thickness of glacial sediments when utilizing the Tromino Passive seismic tool. All these data subsets that were not previously integrated are now available to prepare more comprehensive surface and subsurface “3D” map products. Maps produced by the combination of remote technology and field derived data can more rapidly provide that “derivative” data to better understand the geologic natural resources of aggregates and groundwater, as well as providing mapping details to document depth and thickness of the glacial sediments for an improved assessment of groundwater pathways. This information is needed in the event of a major spill which can result in a release resulting in an environmental catastrophe. Additionally, these data can support defining the direction and flow of recently identified PFAS contamination which the latest water sampling has shown is statewide, and is a result of all phases of Michigan’s economy and social infrastructure. The MGS mapping research has confirmed that mapping the stratigraphy of the glacial sediments is critical in determining the current and future potential of Michigan’s water resources. MGS has presented the case to multiple Michigan associations and departments that all subsurface geologic information needs to be standardized. There are over 30,000 201-213 regulatory investigation and remediation sites that have collected geologic data. Most of this data is in paper files and would provide a wealth of basic geologic understanding for many areas, as well as provide validation of water well logs. This data has been collected for over thirty years with no funding mechanism or program to compile it into a standard geologic database. The benefits of standardization are in the use of geologic data to support a greater understanding of the subsurface, and in managing all of our geologic resources. MGS is proposing a plan to compile this data to assist in mapping the priority county geology more expeditiously and reduce the amount of drilling that would be required.

MGS has been proposing the need for water well locations needing validation for over five (5) years. Michigan does not validate the location of water well data at the time of entry to Wellogic, therefore, water well data currently represents over 560,000 data points that must be validated for location by each person looking at the files before it can be used. Plus each person that reviews the data, must review any subsurface lithologic data submitted by the driller. In June 2019, MGS was awarded a three year contract totaling $325,401 to correct this Wellogic data, input of 5300 paper logs and nearly 700,000 electronic paper logs into Wellogic and confirm the locations of each log.

In addition, Michigan does not have a formal training program for logging water well drill cuttings by the licensed well drillers. The data validation and driller training program is long term and MGS has proposed and has currently trained new license applicant drillers for the last four years. The Michigan Groundwater Association’s licensed well drillers want to see this type of program initiated to train new and existing well drillers in data collection and data input to Wellogic, which is currently the only standard database. The American Institute of Professional Geologists (AIPG) has also indicated there should also be standardized format and data base for “geologic” data in an open file format.

Remote sensing and airborne surveys

Dr. Mohamed Sultan and his research colleagues in the Remote Sensing Laboratory provide the foundation for understanding the use of satellite and other indirect mapping methods. MGS has funded a Ph.D. candidate, Hossein Sahour who utilized NASA satellite data from the Gravity Recovery and Climate Experiment (GRACE) program from 2002 to 2016 to assess the total groundwater changes in Cass/St. Joseph and Ottawa/Kent counties. The demonstration program was a success and Hossein initiated a statewide Lower Peninsula (LP) analysis as a portion of his doctoral dissertation. The initial results are favorable to understanding and monitoring temporal water storage changes during this time period. This Gravity Recovery and Climate Experiment (GRACE) outlined above represents another research component of the MGS/WMU association that can support the management of the natural resources of the State of Michigan. The success of the recently completed Qatar program has demonstrated the use of Interferometry in mapping subtle subsidence (mm per year) in surface features, a key to identifying active sinkholes, and is now being applied to Lake Michigan nearshore slope/bluff movements.

Michigan has the longest shoreline on the largest fresh water bodies in the world, totaling 3,126 miles. That is more than the entire East Coast of the U.S. at 2,165 miles for 8 states. The mapping of Michigan’s shorelines will greatly enhance our understanding of existing conditions, and allow for the monitoring of changes in shore and bluff configurations as they respond to population impacts and changes in lake levels. Remote Sensing technologies will be an integral component to a collaborative USGS, NOAA and USACE (Army Corp of Engineers) research program currently being planned. The use of Unmanned Aerial Systems (UAS) will also be a component of this Federal research program and the UAS program which is also a new program being developed at WMU in association with the College of Aviation. UAS information will also be invaluable in real time data collection, when integrating the management of surface water resources and runoff during major storm events that can cause extensive structural or environmental damage. Guzalay Sataer is a WMU/GES Ph.D. candidate that is assessing the use of Interferometry data for bluff review and movements with UAS data with time. Guzalay is working with the USGS Bathymetry data team to compile data from the two programs, a project initiated in 2019 and will be publishing interim and final results jointly with the USGS team.

MGS continues to seek funding for permanent staff, office, core repository and teaching facility.

Respectfully,
John A. Yellich, Director
B.A. and M.S., Western Michigan University
Geology, Geological and Environmental Sciences
1. The GES-Earth Sciences Remote Sensing (ESRS) Lab is teaming with MGS and USGS to study the geology and slope failure response along Lake Michigan at 3 locations. This research started in Aug. 2017. This is now a 2-3 year project jointly funded by MGS and USGS and will be Ph.D. dissertation projects for 2 students, Guzalay Sataer and Nicholas Shaw. The team members in the photo are John Yellich, MGS; Guzalay Sataer, WMU (Ph.D.); Tanten Buszka, WMU (M.S.); Dr. Kevin Kincare, USGS; Nicholas Shaw, WMU (Ph.D.); Dr. Ronald Chase, WMU GES Emeriti; Dr. Richard Becker, UoT; Sarah Mcguinness, UoT (M.S.). Note: the drone team are graduates, faculty, staff or students of Geological and Environmental Sciences, except Sarah.

2. Esayas Gebremichael dissertation defense. Esayas is presenting subsidence changes validated with Interferometry data on the Nile Delta. Esayas supported the initial review of interferometry data for mine subsidence and bluff stability in Michigan. Esayas is currently a tenure track faculty member at Texas Christian University.

3. Clayton Joupperi Poster session review of his M.S. work at MBGS meeting at MGRRE. Clay is now employed at Michigan - EGLE in the Water Resource Division.

4. Student led ArcGIS training, what you need to know! Ben Seiderman (left) and Karl Backhaus (right), Tyler Norris, Clay Joupperi (sitting left-right).

5. MBGS monthly seminar at MGRRE, April 2019. Dr. David Westjohn, presenting mapping project results Jackson, MI, MGS- STATEMAP. Dr. Lloyd Schmaltz and Marilyn Schmaltz.


7. Tyler Norris mapping with Tromino as noted in MI Oil and Gas Association Article. Tyler is using energy industry seismic data to support mapping of depth to bedrock. Tyler is employed by the Ohio Geological Survey as a glacial geologist mapper.


9. Bluff research study with USGS, MGS, faculty, M.S. and Ph.D. students. This is a new multi-year study using interferometry and UAS (Drone) technology(s) and other remote sensing technologies of bluff areas in St Joseph, Miami Park South (South Haven) and Pentwater (Ludington) along Lake MI. Visit wmich.edu/geologysurvey to watch the TV8 Wood Grand Rapids interview at MGRRE: What is causing bluffs to fail?

10. Student down hole gamma log training: (left to right) Jay Kim, John Esch (MGS contractor), Mohammed Al Musawi, Ben Seiderman, Zong Geophysical, and Karl Backhaus, New York Geological Survey.
Students in Geophysics class collecting magnetic data.

"I appreciated having the opportunity to develop a familiarity with the equipment used in magnetic surveying. Having such an experience reinforced the concepts that we studied in class; especially during data processing and interpretation."

—Evangelia Murgia, M.S. student
Nathan Erber, Ph.D.  
Sara Hayes, M.S.  
Justin Macks, M.S.  
Nazife Onaral, M.S.  
Nick Shaw, Ph.D.  
Charles Ewing, M.S.  
Ryan Kermicle, M.S.  
Joe McGuire, M.S.  
Austen York, M.S.

M.S. student, Neal Turluck, took home first place in the poster contest at the annual meeting for the Michigan Chapter of AIPG on Nov. 29, 2018. AIPG student members were invited to bring their posters to compete for awards up to $1,000 cash in both undergraduate and graduate levels.

**Student updates**

**Karem Abdelmohsen, Ph.D.**

My name is Karem Abdelmohsen and I am a Ph.D. student. My project, titled “Response of deep aquifers to climate variability”, is a case study from the Nubian Aquifer in Africa, for arid and land research. It reflects my current research focus on the application of integrated geophysical and remote sensing tools for groundwater potential assessment, exploration and sustainable utilization in arid regions (published in Science of T.E.)


**Mohammed Hashim, Ph.D.**

My name is Mohammed Hashim, and I’m a Ph.D. student. I perform laboratory experiments to understand how shallow marine carbonate sediments lithify to limestone as they get buried beneath world ocean

For more information on recent student achievements, visit our website at wmich.edu/geology/academics/achievements

**Stephanie Buglione, Undergraduate**

Undergraduate student, Stephanie Buglione, has been accepted into the NASA L'SPACE Academy’s level 1 spring 2019 program. This program is designed to help students gain greater insight and skills in NASA mission protocols, procedures and practices as well as provide an opportunity to work within an interdisciplinary, co-located team of students that are passionate about science and engineering.

DID YOU KNOW?

Graduate programs began in the late 1960's with a Master's Degree in earth science education, which built upon the highly successful undergraduate earth science teaching program, that was headed by Dr. Passero. The Geology Club at WMU was established in 1965. In 1970-71, a master’s in geology was initiated and the department’s research activities, which had always been strong, were brought to the forefront. Graduates found excellent employment opportunities in the petroleum and mining industries.
American Association of Petroleum Geologists

This past year was an unusually quiet year for the American Association of Petroleum Geologists (AAPG) student Chapter at Western Michigan University. After sending team members to Pittsburgh for the AAPG Eastern Section Imperial Barrel Award (IBA) Competition in 2015, 2017, and 2018, and achieving second place in 2017, this past year represented a hiatus in competing for the Western Michigan University student chapter. Although our student chapter did not compete in the Eastern Section IBA Competition, we did represent WMU at the annual national AAPG conference giving talks and presenting posters. The 2019 AAPG Annual Conference and Exhibition was held in San Antonio, TX in May 2019. Dr. Harrison, Dr. Kaczmarek, and Dr. Voice all attended and participated in various events and activities throughout the week. Additionally, 4 WMU students including Mohammed Hashim, Cameron Manche, Katherine Rose, and Brooks Ryan, presented both oral presentations and posters in technical sessions as well as at the SEPM Carbonate Research Group meeting. The WMU AAPG student chapter is always seeking new members and looks forward to another productive year at the Annual Convention and Exhibition as well as the IBA Competition!

Geology Club

The 2018-19 school year has ended, with that we said good bye to many good students and officers who helped drive the club. For the 2019-20 school year, we have a whole new set of faces for the club officers; the President is Michael Leonard, Vice President is Michael Roberts, the Treasurer is Evangelia Murgia, and the Secretary is Guzalay Sataer. As officers, we have some exciting things in motion, including seminars—where students come in and present on interesting geologic topics or research they are doing. We will be going out on field trips with local businesses to hear what it's like to be a geologist in the modern day. And lastly, more fundraising this time with a focus on getting the geology club's presence known and heard around campus! Sadly, the 2018-19 school year did not end with the club going on any extended field trip. Not to worry, this year the club will be going on a trip that will be valuable to everyone in the club. This trip will be decided on in our first couple meetings in Sept.! 2019-20's trip will focus more on the geology of a place and having students lead the club through their chosen destination so that each student can be a part of the planning process. This year is setting up to be a good year for the geology club at WMU.

Society of Exploration Geophysicists

Though we did not have many events this past academic year, we still hosted our annual welcoming dinner for new graduate students. This year around 24 students attended the event. The purpose of the event is to strengthen the bonds between the graduate students (new and returning). We hope that this year more students become involved in our SEG RSO and are looking forward to another great year of events!
Rood Hall, the new home of the Department of Geological and Environmental Sciences, was constructed in 1970. Faculty growth thereafter was extremely rapid. By 1971, the faculty totaled seven, with three relatively new members: Drs. John Grace, Richard Passero and W. Thomas Straw, all of whom subsequently played major roles in the department for years to come, along with several others of shorter tenure.
Endowments and grants

**ENDOWMENTS**

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<tr>
<th>ENDOWMENT</th>
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<tr>
<td>Alan E. Kehew Endowment</td>
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<td>Alumni and Friends of Geosciences Endowment</td>
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<td>Department of Geosciences Endowment</td>
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<td>Douglas Daniels Endowed Geosciences Scholarship and Award</td>
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<td>Geosciences Advisory Council Quasi-Endowment</td>
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<td>Geosciences Graduate Student Scholarship Fund</td>
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<td>Geosciences Operating Quasi-Endowment</td>
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<td>John and Kelly Grace Endowment of Geosciences</td>
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<td>Laton-Lambright Field Camp Scholarship Endowment</td>
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<td>Lloyd Schmaltz Museum of Earth History Endowment</td>
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<td>Mohamed I. Sultan Endowment for Geosciences</td>
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<td>Randall Kerhin Graduate Scholarship in Geosciences</td>
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<td>Shirley J. Aiken Geosciences Scholarship</td>
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<td>The Roger and LuAnne Steininger Geology Scholarship in Honor of Dr. Lloyd Schmaltz</td>
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<td>W. David Kuenzi Memorial Quasi-Endowment</td>
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<td>William and Linda Harrison Endowment</td>
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**Total** $489,674.10

**MGRRE**

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**PENDING ENDOWMENTS**

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<td>Geosciences Study Abroad Endowment</td>
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<td>Peter J. Kaczor Geology Scholarship</td>
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<td>Ronald Chase Endowment</td>
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<td>Chris Schmidt Endowment</td>
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<td>Tom Straw Endowment for Geosciences</td>
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**Total** $18,128.00

**GRANTS**

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<td>William Harrison</td>
<td>U.S. Geological Survey</td>
<td>Preservation Of Unique Drill Cuttings and Assembling Geologic Data for Critical Minerals</td>
<td>$83,693.00</td>
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<td>Steven Kaczmarek</td>
<td>ExxonMobil Research Qatar</td>
<td>Investigating the Early Diagenetic History of Miocene Limestones and Dolostones</td>
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<td>Heather Petcovic</td>
<td>National Science Foundation —ISU GeoPaths</td>
<td>GP-EXTRA: Fostering Interest in Earth Science Teaching Through the Reflective Practice of Science</td>
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<td>Saudi Geological Survey</td>
<td>Training on Hyperspectral Remote Sensing for Geol. Mapping</td>
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<td>The National Academy of Sciences</td>
<td>Natural Discharge for Agricultural Development and a Substitute for Reduced River Nile Flow</td>
<td>$40,086.00</td>
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<td>Joyashish Thakurta</td>
<td>American Councils for International Education</td>
<td>Geological Characterization of Economic Mineral Deposit in Eastern Kazakhstan</td>
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<td>John Yellich</td>
<td>MDEQ</td>
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<td>U.S. Geological Survey</td>
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<td>U.S. Geological Survey</td>
<td>GLGMC #1 Geologic mapping Edwardsburg Cass Co &amp; #2 FEDMAP Collaboration, shoreline studies</td>
<td>$89,835.00</td>
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**Total** $1,800,230.00

**Make a donation**

Your contribution enriches the experience for current and future students, faculty, and staff by adding an extra margin of excellence to our program which, as a result, helps us to attract top faculty and students. Additionally, your contribution creates opportunities for research, scholarships, field opportunities, fellowships, campus enhancements and more. To make a gift, visit wwmich.edu/geology/giving
Awards and achievements

**UNIVERSITY AWARDS**
- Mohammed Al Musawi — Department-level Graduate Research and Creative Scholar Award
- Shelby Hurst — All University and Department-level Graduate Teaching Effectiveness Award
- Sita Karki — Department-level Graduate Research and Creative Scholar Award
- Cameron Manche — Graduate College Student Travel Grant
- Evangelia Murgia — College of Arts and Sciences Undergraduate Research and Creative Activities Award
- Tyler Norris — All University and Department-level Graduate Teaching Effectiveness Award, Graduate College: nominated to present at the 13th Annual Research and Creative Poster and Performance Day
- Nicholas Shaw — Departmental Presidential Scholar

**EXTERNAL AWARDS**
- Mohammed Al Musawi — Geological Society of America Graduate Student Research Grant (GSA 2018)
- Stephanie Buglione — Acceptance into the L’SPACE spring 2019 Level 1 Academy
- Cameron Manche — Society for Sedimentary Geology Travel Grant
- Brooks Ryan — Society for Sedimentary Geology Student Participation Grant (AAPG ACE 2018 and 2019), Shell Student Travel Stipend Grant - Top 15 Student Poster Abstract (AAPG 2018), American Association of Petroleum Geologists Best Student Oral Presentation Award (AAPG ACE 2018)
- Neal Turluck — American Institute of Professional Geologists Michigan Section: Best Graduate Student Poster (1st place)

**SERVICE AWARDS**
- Distinguished Advisory Council Member
  Sara Pearson
- Distinguished Career Award
  William Sauck
- Recognition Award
  Dr. Roger and LuAnne Steininger
- Faculty Service Award
  Andrew Caruthers, Robb Gillespie
- Staff Service Award
  Jennifer Trout
- Distinguished Student Service Award
  Hannah Pankratz

**DEPARTMENTAL AWARDS**
- Advisory Council Endowment
  Kareem Abdelmohsen
- Alan E. Kehew Endowment
  Madison Wayt
- Core of Four Endowment
  Conner Carpenter
- David Kuenzi Research Grant
  Kareem Abdelmohsen
- Douglas Daniels Endowment
  Beau Haag
- Empowering Geosciences Endowment
  Hossein Sahour
- Envirologic Technologies Endowment
  Katie Sauer
- John and Kelly Grace Endowment
  Aaron Ward
- Kalamazoo Geological and Mineral Society
  Guzhaliayi Sataer, Neal Turluck
- Laton-Lambright Field Camp Endowment
  Kevin Nguyen, Chanho Park
- Lauren D. Hughes Environmental Scholarship
  Stephanie Buglione, Madison Wayt
- Lloyd and Marilyn Schmaltz Prof. Activities Award
  Beau Haag
- Mohamed Sultan Endowment
  Guzhaliayi Sataer
- Randall Kerhin Graduate Endowment
  Katharine Rose
- Roger and LuAnne Steininger Geology Scholarship in honor of Dr. Lloyd Schmaltz
  Evangelia Murgia
- Shirley J. Aiken Geosciences Scholarship
  Aaron Ward
- William and Linda Harrison Endowment
  Cameron Manche, Madison Wayt
- Undergraduate Senior Honor Awards
  Earth Science Education - Timothy Brau
  Earth Science - Kyle O’Brien
  Geology - Elizabeth Gains
  Geophysics - Mohammed Al Hooti
  Hydrogeology - Erin Huggett
Department publications

**DR. STEPHEN KACZMAREK**


**DR. MICHELLE KOMINZ**

2018 G. Tagliaro, C.S. Fulthorp, S.J. Gallagher, C.M. McHugh, M. Kominz, and L.L. Lavier, Neogene silicilastic deposition and climate variability on a carbonate margin: Australian Northwest Shelf, Marine Geology v. 403, p. 285-300. doi.org/10.1016/j.margeo.2018.06.007


**DR. HEATHER PETCOVIC (* indicates student co-author)**


**DR. MOHAMED SULTAN**


**DR. JOYASHISH THAKURTA** *(Italics are students supervised by Thakurta)*


Koerber, A. and Thakurta, J., 2019, PGE-enrichment in magnetite olivine gabbro: New observations from the Midcontinent Rift-related Echo Lake intrusion in northern Michigan, USA, Minerals, 9, 21, doi.org/10.3390/min9010021


**Secretary.**
DID YOU KNOW?

In the 1970's and 1980's, Dr. Lloyd Schmaltz led a legendary Grand Canyon river rafting trip that drew enthusiastic crowds for over two decades!