



WESTERN MICHIGAN UNIVERSITY
College of Arts and Sciences
Department of Geological
and Environmental Sciences

FALL 2020 NEWSLETTER

Geosciences in the time of COVID-19



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From the Department Chair



Dear faculty, staff, students, alumni, emeriti, and friends,

When I agreed to return to the department as the next chair in late 2019, little did any of us know that 2020 would be a year of turmoil, challenge, grief, and anxiety. Since rejoining the department in July, I have been continually grateful and humbled by how our Geological and Environmental Sciences family has worked together and supported one another through these times. From innovative online teaching of our classes, to continued research productivity, to our first-ever virtual alumni homecoming event, we have adapted and adjusted to the challenges that this year has thrown at us.

In the spring 2020 semester, our faculty, instructors, and teaching assistants rapidly moved all courses and labs online in a matter of days when Michigan's shelter-at-home order took effect. My appreciation and admiration for these efforts cannot be understated – our instructional staff were able to finish out the semester delivering the high quality courses and cutting-edge science that we are known for, albeit in quite a different format (virtual rocks? online outcrops?). Although we were not able to celebrate the milestones of student accomplishments with our annual award banquet this past spring, 15 undergraduates and 13

graduate students earned their degrees in 2019-20 and joined our ranks of proud alumni.

Thanks to the efforts of Dr. Joyashish Thakurta and Dr. Robb Gillespie, we were able to convert our geology field methods and mapping courses to a virtual format. Sadly, we had to cancel both summer sessions of the Hydrogeology Field Camp, although many of the students remain interested in joining us next summer. We plan to run both the field mapping course and the HFC in person for summer 2021.

The university's switch to online offerings coupled with the economic impacts of COVID-19 to state revenues resulted in an overall WMU budget reduction of \$76 million, approved by the Board of Trustees in September. The College of Arts and Sciences experienced just under a \$12 million budget reduction, representing about 20% of the College's permanent operating budget. These budget cuts have translated into painful losses for the department. Annual contracts for two of our faculty, Dr. Robb Gillespie and Dr. Andrew Caruthers, were not renewed. Although they are not able to teach in the department this year, we were able to secure part-time research appointments for both of them through the MGS. Our search for a new tenure-track faculty member affiliated with MGS/MGRRE was cancelled and the position was cut. One of our administrative assistant positions was eliminated, and we sorely miss the talents of Ms. Shellie Gates, who not only prepared this newsletter for the past several years but also handled graduate admissions. Several of our other staff have reduced hours and all WMU employees have taken pay cuts. Progress on construction of the Dinosaur Park and Schmaltz Museum were temporarily halted while campus was closed. Our operating budget was cut by half, reducing the funds that we have to support faculty and student research, travel, and conference attendance.

Aside from financial impacts, faces in the department have changed in the past year. Dr. Bill Sauck officially retired in Spring 2019, and Dr. Alan Kehew joins us for a final fall semester before his retirement in January 2021. Both will be sorely missed as leaders and highly respected

scientists. And we together mourn the passing of two former faculty, Dr. Richard (Dick) McGehee and Dr. Richard (Dick) Passero. You can find remembrances of Dr. Passero's contributions later in this newsletter.

Despite the current challenges, I am confident that the department remains strong and resilient. We are delighted to formally welcome Dr. Peter Voice as our newest tenure-track faculty member. Dr. Voice has been with the department in a contract position for several years, but his new role includes teaching both undergraduate and graduate courses, research in Michigan Basin stratigraphy, and Director of Graduate Studies. I also welcome Drs. Steve Kaczmarek and Matt Reeves as permanent members of the department, both having achieved tenure in the past year. Dr. Reeves received a prestigious award this fall, one of only three WMU Named Term-Limited Professorships. This a renewable, three year award providing funding to support his work in developing innovative approaches to investigate the environmental transport and fate of PFAS.

I also find inspiration in the past leaders of the department. Under Dr. Mohamed Sultan's leadership (2004-2020), the department added new undergraduate majors in geochemistry, geophysics, hydrogeology, secondary integrated science education, and environmental geology. We expanded our doctoral program from hydrogeology to geosciences, added a non-thesis MS Earth Science degree, and created an accelerated Masters program enabling students to earn both a BS and MS in five to six years. We greatly expanded our online offerings, including popular online introductory courses, the first fully online STEM minor in the College of Arts and Sciences (Earth Science minor), and online certificate programs in hydrogeology and unoccupied aerial vehicles (UAVs). Five tenure-track faculty joined the department, two of whom are now tenured members of the faculty (Reeves and Kaczmarek). The Michigan Geological Repository for Research and Education (MGRRE) moved to its current facility, growing both its collections and operations. In 2011, the Michigan Geological Survey (MGS) was moved to WMU – which, together with MGRRE,

provides opportunities for student and faculty research as well as public engagement. Investments in the Schmaltz Museum and Dinosaur Park have made Rood Hall a go-to location for casual visitors and tour groups alike.

This fall marks the launch of our new undergraduate major in Environmental Geology. It also marks a significant change in teacher education at WMU; in the new program, future teachers complete a content-focused undergraduate major (we offer Earth Science and Integrated Science) and then enroll in a Masters of Arts in Teaching program for initial certification. Our undergraduate enrollment remains healthy with just under 100 majors across 8 programs of study. We currently have 50 graduate students, 19 in our doctoral program, 26 in our Masters programs, and the remainder in our graduate certificate programs. In research highlights, the department garnered \$1,476,731 across 12 new grants in 2019-20, including a \$500,000 state appropriation to fund the work of the MGS. You can read more about this award in the MGS and MGRRE updates. Our faculty published 32 peer-reviewed papers in 2019-20, 16 of these with a student as the first author and the majority with student co-authors. These numbers indicate just how much we value engaging our students in our research endeavors.

While the challenges that face the department are daunting, we are already finding our way though. We have come together to review our graduate and undergraduate curricula, to ensure that we are offering the best quality programs and courses with our current staff and faculty. We are taking action to stabilize the funding of both the MGS and MGRRE, including embarking on a fundraising campaign to purchase the MGRRE facility, and working closely with the WMU Government Relations office and State Geologist to secure ongoing state support for MGS. We are ever grateful for the generosity of our departmental friends and family – your donations have enabled us to support students through numerous scholarships and awards. Throughout this newsletter, I highlight several high priority funds and fundraising initiatives. Please think of us through the giving season and beyond.

If you are still reading this, thank you and I'll conclude with some personal remarks. For those who don't yet know me, I joined WMU in 2004, after completing my undergraduate degree in Geology at Smith College (1995) and both my MS and PhD in Geosciences at Oregon State University (2000 and 2004, respectively). After completing my graduate research in igneous petrology focused on feeder dikes to the Columbia River flood basalts, I switched my research interests to teaching and learning geosciences after participating in a year-long teaching fellowship. My current research focuses on how students learn to think and solve problems in the field, and on the role of spatial 3D thinking in learning geology. I have been out of the department "on loan" to the College of Arts and Sciences, where I served as an Associate Dean for the past three years. I am delighted to return to my home department and discipline. I hold a joint appointment in the Mallinson Institute for Science Education, where I currently supervise one doctoral student (Samuel Nyarko), in addition to two Geosciences MS students (Kristen Foley and Nina Morris), though I expect my group will expand this year with new students. Together with my students, I've published 25 peer-reviewed papers (plus numerous editorials and white papers) and have acquired \$2.3 million in external funding, mainly from the National Science Foundation. Current funded projects include a novel way to prepare future science teachers by coupling summer research with teaching, a multi-institution NSF-ADVANCE project aimed at improving the recruitment and retention of women and faculty of color in the sciences, and (hopefully) a new project investigating the role of spatial thinking in hydrogeology. My husband works as a geologist in environmental consulting, which I greatly value as a peek into the "real world" of geological employment. My family includes two cats, two guinea pigs, and two daughters, ages 12 and 15, who enjoy martial arts, music, drawing, and any and all things related to dragons. When not working, I can be found gardening, biking, drinking coffee (or Michigan wine), practicing yoga, or just reading a good book in the hammock.

As we experience the Fall 2020 semester and look to the year ahead, we are adapting to a world utterly changed by COVID-19 and by the recognition that systemic racism and injustice affects us all. I am confident that with the support of our friends, alumni, faculty, and staff we can be the best possible department for our students. At some point in the future, I invite you to join us - we do not yet know whether we will have an in person spring awards banquet, but whatever the format we will celebrate our accomplishments and what we achieve over the coming year together.

Dr. Heather Petcovic
Chair, Department of Geological and
Environmental Sciences

Faculty Updates

Dan Cassidy

Hello,

This past academic year (2019-2020) I was on sabbatical leave and I spent my time and energy researching per- and polyfluoroalkyl substances (PFAS). As you may know, Michigan is on the first states to aggressively characterize the PFAS contamination problem, in drinking water and the environment at large. I was lucky to have had the opportunity to collaborate with several individuals at the Michigan Department of Environment, Great Lakes, and Energy (EGLE). I was able to collect a lot of samples of PFAS-contaminated soils, sediments, leachates, sludges, and foams on surface waters in Michigan other states, as well as in Canada, where I spent the latter half of my sabbatical leave (February-August 2020). The COVID-19 restrictions in the laboratories where I was doing research in Canada had similar physical distancing restrictions as in most places the United States, but most people dared not enter, so I was able to get even more research done than I could have imagined. Masks and gloves were mandatory, and they even provided N95 masks for those who were brave or bored enough to enter the labs.

During my sabbatical I was also fortunate enough to begin collaborating with one of our younger colleagues, Matt Reeves. He's also doing PFAS research with the support of EGLE and has at least one grad student mining information on EGLE sites contaminated with PFAS, to begin understanding how PFAS behave in the subsurface. We should count ourselves very lucky to be researching PFAS in the state that has probably done more site characterization work on PFAS than any other. I expect the relationship between EGLE and our department to be fruitful and mutually beneficial for years to come.

Andrew Caruthers

Hello Everyone!

Over this past year we are happy to announce the birth of our daughter Esther Mary in December. She has been a wonderful addition to our family and we (all) have enjoyed seeing her grow these past 7 months. In research news, I am excited to report a grant from the National Science Foundation for \$590,000 to fund my project in Alaska. This is a three-year grant and we are planning a return to the beautiful Wrangell Mountains next summer to collect more samples from our site at Grotto Creek. I have been busy (along with my colleagues) writing three initial manuscripts for this project that focus on our collective data from our 2017 and 2019 fieldwork and are planning to submit this work for publication this fall.



Our children Ben (4 years old) and Esther "Streetie" (7 months old) enjoying a beautiful summer day.



Panorama of a small slump in the lower McCarthy Formation occurring just below the Norian / Rhaetian boundary (Upper Triassic) at Grotto Creek, Wrangell Mountains in southern Alaska.

Steve Kaczmarek

Hello all! I hope this brief missive finds you healthy and safe in these trying times. The end of the spring semester was a bit rocky, but the ship has been righted, and I'm now somewhat adjusted to the "new normal... Although the Carbonate Petrology and Characterization Laboratory (CPCL) was in hibernation for a few months from March to June, our research efforts have continued to move forward. Here are a few highlights from the team:

Brooks Ryan (Ph.D. 2020) is now a post-doctoral researcher in the CPCL. He defended his dissertation in April and is continuing for the next year with his industry-funded project on diagenesis in the Eocene carbonates of Qatar. As part of his dissertation, Brooks published 2 papers in *Sedimentology*, is working on revisions for a paper in *Geology*, and has another paper about to be accepted in the *Journal of Sedimentary Research*. It's no surprise that he was the 2020 department nominee for the All-University Research Award. He will soon be starting a 10-week internship with Chevron.

Mohammed Hashim (Ph.D.) has continued making great progress with his laboratory experiments that he's conducting for our NSF calcite microcrystal project. He recently published a very cool research paper in *Earth and Planetary Science Letters*, has another in review in the same journal, and is putting the final touches on a manuscript for *Geochimica et Cosmochimica Acta*. He has been doing interesting work that has challenged long-standing paradigms about how carbonate sediments stabilize in the marine setting. This is the final year of his Ph.D. program.

Cameron Manche (Ph.D.) has been working as a researcher at Texas A&M. We are currently awaiting the reviews on his second paper submitted to the *Journal of Sedimentary Research* (his first paper was published in *Geology* in 2019). We are also in the process of putting the final touches on his third manuscript in preparation for his Ph.D. dissertation defense this fall.

Mohammed Al-Musawi (Ph.D.) is now knee-deep into our industry-funded project focused on the Miocene carbonates in Qatar. These rocks are extremely complicated and are challenging many of our preconceived notions about carbonate diagenesis. On nights and weekends, Mohammed continues his work on the Burnt Bluff Group (MI Basin), the topic of his M.S. thesis. He recently published a paper in *Applied Geochemistry* and is currently working on two other manuscripts on the Burnt Bluff.

Katharine Rose (M.S.) is currently in Houston completing a summer internship with ExxonMobil. On nights and weekends, she's working on writing up the findings of her M.S. research on the effects of precursor mineralogy and texture on dolomite stoichiometry. She will be back next fall to defend her thesis and put the finishing touches on her manuscript.

Sarah Hayes (M.S.) participated in a virtual field camp this summer and is gearing up to start her thesis research in the fall. Her plan is to investigate the use of mercury as a paleoenvironmental proxy for the Niagaran-Salina section in the MI Basin. This work will build on Matt Rine's (Ph.D. 2019) carbon isotope work, which was recently published in *Palaeogeography, Palaeoclimatology, Palaeoecology*.

Ashley Scott (Ph.D.) recently moved to Kalamazoo and will begin her graduate program in the fall. Ashley is coming to us from Texas, where she recently completed her M.S. degree at Midwestern State University. She comes highly recommended, and we're very excited to have her join our team. She will start working on the Saluda Fm. dolomites (Ordovician) in southern Indiana and will be the TA for the Sed/Strat class for the next few years.

As you can see, these fine folks have been a busy bunch. If you see them around, be sure to congratulate them on all their academic accomplishments. As for me, I've continued to update my courses in preparation for the fall. I've also been writing papers, proposals, and letters of recommendation for all the fine folks that work with me.

Take care and best wishes,

Steve K.

Al Kehew

Hi Folks,

I don't think I said anything last year, so I better put in my two cents worth this time. I've been on medical leave since last fall dealing with melanoma. I went to U of M for treatment and they started with immunotherapy because the area on my scalp was too large for surgery. These are very new drugs that work great for some people, but it caused my immune system to go berserk and attack my liver, heart, and brain. So, I could only last through 2 infusions. Since then, I have been on what's called targeted therapy, which is another very new approach. These are oral meds that act directly on a mutation of the cancer cells, which I am lucky to have. Only about 40% of melanoma patients have this particular mutation. It has really worked so far, and I am doing very well now, except for some minor issues. I also announced my retirement for the end of this year and moved to Maine where I built a house last year and am finishing the medical leave here. I go to Boston now for treatment, which I don't like as much as U of M because of the crazy traffic and congestion in the city. I probably will be going there on a regular basis for the foreseeable future because melanoma has a nasty habit of returning just when you think it might be gone for good.

Anyway, I am still doing as much geological stuff as I can. This summer I finished an updated surficial map of St. Joseph County that I mapped, along with some people who are probably reading this newsletter, more than 20 years ago. I hope to also complete maps for Kalamazoo and

Van Buren counties through the Michigan Geological Survey. I was part of a group of people from Indiana, Illinois and Michigan who wrote a paper on the Kankakee Torrent, a catastrophic flood which we think started in glacial Lake Dowagiac in Michigan and went all the way down to the Gulf of Mexico. That paper will be coming out in a new GSA special paper probably by the time you read this. I am also working on a fourth edition of my Geology for Engineers textbook, that will be published this time by Waveland Press. It was dropped by Pearson after 30 years and 3 editions. Even though it had a loyal following, it never generated the kind of sales that a regular physical geology book does. My last 3 MS students, who were co-advised by Bill Sauck and Robb Gillespie (Karl Backhaus, Ben Seiderman, and Tyler Norris), were among the best I have had over my 34 years at WMU. I'm also going to be active on Nate Erber's PhD committee.

Being a part of the department at WMU has been an honor and privilege and the high point of my career. The best part was interacting with many of you when you were here as well as great colleagues, faculty and staff, in the department. I'll stay informed and active in departmental affairs as long as I can and if anyone happens to be travelling through New England, my spare room is available, and I will cook lobsters for you.

Michelle Kominz

What did I do this past academic year? Mainly I taught classes. Not many classes either. In Fall 2019 I taught Introduction to Geophysics (a whole earth perspective). That kept me at work from 7:30 a.m. to 8, 9 or 10 p.m. most evenings. And weekends. I was hoping that my second attempt in Fall 2020 would be less time consuming. But with COVID, the lecture part is going to online and much of what I did in class is going to be available in an asynchronous form. So, it is going to be at least as bad if not worse. In spring 2020 I taught what should be an easy class, Ocean Systems. However, when we shifted to distance education after spring break, I switch to asynchronous lectures. And that proved to be extremely time consuming. I must sympathize

with the late-night comedians – trying to deliver an enthusiastic lecture to my blank, unresponsive computer screen is not exactly my forte.

In Fall 2019, a paper on the recent tectonics of NW Australia was published in EPSL (Earth and Planetary Science Letters) with 2 colleagues from IODP Expedition 356.

A second paper on Pliocene sea level, based on data from the North Island of New Zealand was published in Nature. This was a PhD project that I was involved with from a University of Wellington student.

Katie Dvorak continues to work on the subsidence/uplift of the Canterbury basin in the South Island of New Zealand. She is about to submit a manuscript on her work to Basin Research.

I have taken on a new MS student, Ryan Kermicle will work with me on thermal modeling of Michigan Basin Wells. We hope to use the MGREE data base to improve our estimates for the thermal conductivity of Michigan Basin sedimentary rocks.

I hope that you all are surviving and even thriving, despite the issues that our nation faces this year.

Giving Opportunity

PLEASE CONSIDER A GIFT TO HELP OUR CURRENT UNDERGRADUATE AND GRADUATE STUDENTS FUND THEIR STUDIES, RESEARCH OPPORTUNITIES, FIELDWORK, AND OTHER ACTIVITIES. DONATE TO ONE OF OUR MANY STUDENT SCHOLARSHIPS:

[HTTPS://WMICH.EDU/GEOLOGY/GIVING](https://wmich.edu/geology/giving)

RV Krishnamurthy



March 7th, 2020, at the SFO International Airport

Red Eye Flight to O'Hare (Oh No!)

Gleefully accepted free upgrade to Business Class

Only one passenger on the two-seater, but he heavily masked

Didn't know why, but ignored

Perhaps a celebrity, sitting next to a normal mortal.

March 8th, landed at O'Hare and connected to the AZO (Kalamazoo) flight

Back home safe and sound.

March 17th or there about, Lock down in "Pure Michigan"

Forty-eight hours granted by the Broncos (Western Michigan University)

To go from face to face to online

Accomplished!

Graduate students ready to graduate

Cut off and impatient with the adviser

Understandable, but COVID 19 ruled the world!

Someone says "Wuhan", someone "China"

Someone "Wuhan, China and Bats"

An unanswerable question, indeed.

But no time to ponder over.

Time to learn Media Encoder, Adobe After Effects

For the Fall, All Greek and Latin.

But no other way, with long wait

At the "Technology Support Office"

Layoffs and terminations there too!

As one goes to press, any silver lining?

Perhaps, all before COVID Lock Down

Paper at the Goldschmidt Conference in Barcelona

Paper at the AGU (American Geophysical Union)

Hope the sun shines brighter tomorrow

And the C(LOUD)OVID clears and is history!

Om Shanti (peace) Shanti(peace) Shanti(peace)!

Matt Reeves

Another productive year has flown by! In reflecting upon all that has happened, I'd like to first focus on Tanten Buszka and Madi Wayt who both successfully defended and graduated this spring. They were highly motivated and productive students, and I wish them the best in the future endeavors. We published a paper in *Groundwater* detailing a pneumatic slug manifold design for hydraulic testing. I am very pleased to report that Tanten received the All University Award for his excellence in research and contributions to his own research project investigating the transport of septic nitrogen in Florida and Madi's pneumatic slug testing project.

Romeo Akara has made outstanding progress on his dissertation research, and we recently published a paper in *Hydrogeology Journal* on characterizing fractured media using UAV imaging. Romeo and I are currently finishing a manuscript involving the reanalysis fracture maps available in the literature to study the spatial organization of fractures. Our findings show that fractures exhibit a higher degree of spatial organization than the commonly held belief of Poisson spacing – this has significant impacts on all studies involving fluid flow and contaminant transport, as past studies (including many of my own) underestimated the complexity of fracture networks.



M.S. students Madi Wayt and Tanten Buszka performing high resolution pneumatic slug tests at a PFAS contaminated site in Muskegon.



Ph.D. student Romeo Akara flying a drone to study fracture patterns in a sandstone outcrop located in the Volta basin in northern Togo.

I currently have five graduate students that are working on a diverse set of projects:

- Romeo Akara – Fracture network characterization, fluid flow and solute transport/climate change impacts on basin scale water resources;
- Xiang Fan – Spreading properties of the 4th rank Gaussian dispersivity tensor using anisotropic geometrical symmetries;
- Ross Helmer – Investigating Michigan PFAS contaminated sites to define general PFAS fate and transport characteristics;
- Evie Murgia – Studying geometrical properties of columnar basalts and their influence on fluid flow and contaminant transport; and
- Austen York – Comprehensive study of Spring Valley sub-watershed to the Kalamazoo river to define geochemical and nutrient fluxes and investigate potential linkages between surface water and municipal production wells.

Each of these students is making impressive progress on their research.

As mentioned under Ross' thesis topic, I continue to conduct research into the fate and transport of PFAS, have been working with Ross to utilize the wealth of data generated by Michigan EGLE and am collaborating with Dr. Dan Cassidy on stabilization/solidification. I led a proposal to NSF MRI program with faculty members (Cassidy/Dogan) from our department, Biology, Chemistry and Engineering to obtain a high-end LC/MS-MS instrument for regular and exploratory quantification of PFAS in a variety of media (water, foam, biosolids, plant tissue). The reviews were encouraging, and we will be revising the proposal and resubmitting early in the New Year. A collaboration with Dr. Tahseen Saaed, a recently graduated Chemistry doctoral candidate, generated a manuscript on PFAS degradation by reductive defluorination

techniques that is currently under review in a chemistry journal.

Lastly, I am very happy to announce that I have been awarded tenure. I would like to thank my fellow colleagues, staff, students and administrators for their numerous contributions to my personal success at Western.

Mohamed Sultan

Greetings alumni and friends of GEOS

I am fortunate to have had the opportunity to serve as the Chair of the department of Geological and Environmental Sciences since joining Western in 2004 till summer of July 2020 when I stepped down. This was a rewarding and pleasant experience for me working with a group of talented, collegial, and dedicated faculty, staff, Advisory Council members, and alums. I will always cherish this experience. It was time for me to step down and give our young, energetic, and capable faculty the opportunity to step in and take this department to new heights and levels and who could do this better than Heather. A super scientist and educator who understands how Western works, an experience she gained from working as an Associate Dean for the college of Arts and Sciences before returning to her home department.

There was one more reason for me to step down. Over the years, my research responsibilities have grown quite a bit and I felt the need to spend more time working with my students. At one time I had eleven PhD students, nine are Western's students, and two are working towards their degrees under my supervision and upon completion of their PhD-related research, they will be awarded their degrees from their home country institutions. In 2019, our research team published six articles in Science of the Total Environment, Remote Sensing, International Geology Reviews, Earth and Planetary Science Letters (2), and Journal of Hydrology and in 2020, we published four articles in Science of the Total Environment, Remote Sensing (2), and Holocene. Two additional articles are currently in review in Surveys in Geophysics, and Earth Science

Reviews. Two of my PhD students graduated this year (Hossein Sahour and Fahad Alshehri) and three will graduate in fall of 2020 (Karem Abdelmohsen, Hannah Pankratz, and Abdelaziz Aljamaz). If all goes well this will be the largest group of PhDs coming out of my lab in a single year. Hossein accepted a postdoctoral position in the University of Texas at Austin and Fahad accepted a tenure track Assistant Professor Position in King Saud University.

We continue to be one of the very few groups in the USA who are on NASA's GRACE Science team and we were recently funded (~500k; 2020-2024) to investigate the hydrologic setting, response, recharge and discharge of fossil aquifers in Saharan Africa and Arabia. We are also funded by the National Academy of Sciences to identify near-surface groundwater using satellite data, by Qatari Ministry of Municipality and Environment (MME) to monitor land deformation across the country of Qatar using radar interferometric methods, and by the Saudi Geological Survey to identify mineralization from hyperspectral data.

I want to take this opportunity to thank you all for your support throughout the years, your valued input, and collective wisdom. Special thanks go Kathy who was instrumental in carrying out day to day departmental matters, taking care of our students, and assisting in implementing our initiatives. I will be on a sabbatical leave in fall of 2020 and will be returning in spring 2021. I am looking forward to taking over added teaching responsibilities and to interact with my colleagues, Advisory Council members, and alums in my new capacity as a faculty member.

Peter Voice

This past year has been hectic, as I interviewed for a tenure-track position within the Department, while maintaining the CoreKids program, teaching 6 courses and acting as Department Graduate Advisor. This year I also chaired the Department's Graduate Admissions Committee. All the hard work since Fall, 2012 paid off – as I accepted the tenure track position!

The CoreKids program started out strong in the Fall and early Spring – but has faced a lot of cancellations in the last few months. Unfortunately, most of our normal events in the Fall have been canceled as well – so CoreKids will be on hiatus for the near future. I took the reins of the Presidency of the Michigan Earth Science Teachers Association (MESTA) in October. My duties with MESTA include working on planning a Fall Conference – which will be MESTA's first experiment with a virtual conference. I was also actively involved in the selection committee for the American Association of Petroleum Geologists Teacher of the Year Award. I took on Undergraduate Advising within the Department for the Earth Science Teaching and Integrated Science Secondary Education Programs.

In terms of teaching, I dusted off two courses that I had not taught in a while – Clastic Petrography and Introduction to Soils and taught them in the Fall. In addition, I taught Dinosaurs twice – with the spring class being the largest group yet (almost 250 students!). I continue to teach Historical and Structural Geology in the spring - so spend a lot of time with our Geology majors.

In terms of research activities, I have supported Bill's activities at MGRRE, assisting with the Critical Minerals Project and a carbon sequestration project in the Trenton-Black River Formations of the Albion-Scipio field. I also dusted off some of the work that I did during my doctoral studies on Detrital Zircon U-Pb age dating. I have been invited to join a committee that is developing recommendations for future zircon geochronological databases.

Giving Opportunity

YOU CAN HELP SUPPORT DEPARTMENTAL INITIATIVES LIKE LAPTOPS FOR STUDENTS, UPGRADED CLASSROOM TECHNOLOGY, AND FUNDING TO SUPPORT STUDENTS RESEARCH. PLEASE DONATE TO THE GEOLOGICAL & ENVIRONMENTAL SCIENCES DEPARTMENTAL FUND – UNRESTRICTED: [HTTPS://WMICH.EDU/GEOLOGY/GIVING](https://wmich.edu/geology/giving)

New Members of the Department

Meet our two newest residents of the Dinosaur Park: Spinosaurus (left) and Parasaurolophus (right).



MGS Updates

Greetings alumni and friends!



The Michigan Geological Survey (MGS) a State of Michigan Department, has been at WMU in the Geological and Environmental Sciences Department (GES) since October 11,

2011. Since 2013, the last seven years, I have served as the Director of the MGS. As presented in previous newsletters, MGS has documented the successful geological research completed for the citizens of the State of Michigan and has been actively involved with both Michigan and national geologic issues that impact the health and welfare of the State and nation. MGS has also supported or funded a number of MS and PhD student's research and has employed WMU students and staff to support MGS mapping and data projects. Since

Mid-2015, MGS has generated the sole funding for the Survey totaling \$3.9 Million from Federal and State grants and this includes two one-time Michigan Legislative Special Appropriations (2016-\$500,000 and 2018 - \$500,000) and effective October 1, 2020, MGS has been provided with an additional \$500,000 to initiate, conduct or continue new and existing programs.

MGS has utilized Geological and Environmental Sciences faculty, staff and students, plus consultants to conduct and support much of this research and produce the MGS professional products and publications during these five plus years. During the last two years, MGS has received letters of support from the Michigan Departments of Environment, Great Lakes and Energy (EGLE), Water Resource Division (WRD), Department of Natural Resources (DNR), Department of Agriculture and Rural Development (MDARD), United Tribes of Michigan and Michigan Farm Bureau. MGS proposed and received a special grant through WRD and EGLE -MPART to support the water resources and the tracking of PFAS transport in the Michigan subsurface geologic formations. This grant of \$925,401 is to support the Health and Welfare of the Michigan water resources. MGS has eighteen (18) students and staff working on this project. All of the current Federal and State grants and appropriations have been received through MGS research proposals and successful research efforts and WMU will receive approximately \$300,000 in overhead fees from this MGS funding.

The Covid Pandemic has put pressure on all scientific functions in the State of Michigan and this includes the MGS at Western Michigan University. WMU will be reaching out to all supporters of MGS to re-enforce the commitment to have MGS and MGRRE remain as a research and scientific resource for the State of Michigan at WMU. As noted, MGS did receive an additional \$500,000 grant, totaling \$1,500,000 in State funds since June 2016. MGS may now continue as a functioning State Department at Western Michigan University in the Geological and Environmental Sciences Department.

This 2020 GES Newsletter article is short, to the point and presents the current MGS facts and we look forward to being here next year and you may see more details of the MGS products on our website. <https://wmich.edu/geologysurvey>

John Yellich, Director

On a personal note, on July 1st, 2020, John Yellich, Director of the Michigan Geological Survey, was elected the 2020-2021 President of the nationally recognized American Association of State Geologists (AASG). John received his bachelor's and master's degrees in Geology from Western Michigan University, and he has his professional certification from the American Institute of Professional Geologists (AIPG) for over 30 years. Previously, John had more than forty years of geologic experience in mineral exploration and development, environmental consulting, business operations and safety compliance. He has worked in more than thirty states conducting environmental, mineral and petroleum assessments in the United States, Canada, Australia and China.

MGRRE Updates



During this challenging year, we are grateful to those of you who have kept in touch with us. We really appreciated your calls and emails because we could still feel connected

to you. We look forward to being with you again and hearing about your renewed efforts. Although MGRRE was closed for several months, we are happily back at our desks and want to share some positive notes from the past year.

Bill Harrison received a new \$120,000 DOE grant through Battelle Memorial Institute to research Trenton/Black River reservoirs for potential EOR technologies. Peter Voice, Jennifer Trout and Linda Harrison complete the WMU

team. West Bay Exploration and Innova Exploration, Inc., are our industry partners.



(left to right) February, 2020, Laura Keister and Amber Conner from Battelle Memorial Institute discuss Trenton cores with Bill Harrison at MGRRE

Bill, Peter and Jennifer continue to work with Battelle on carbon capture, utilization and storage (CCUS) through another research project entitled Regional Initiative to Accelerate CCUS Development, which is a multistate, regional consortium comprised of states in the Appalachian, Illinois and Michigan Basins. Bill directs the on-going USGS/NGGDPP work to archive legacy samples and well records as well as a companion grant to assess and map prospective Michigan formations that may host critical minerals.

In the Fall, Bill and Peter gave presentations on data preservation techniques at the annual Geological Society of America meeting and Jennifer made a presentation at the USGS/NGGDPP meeting. These talks focused on preserving cuttings—why we should keep them and how they are used. Bill, Peter, and Jennifer also made presentations at the Eastern Section AAPG meeting last fall.

Bill, Linda, Peter, and Jennifer worked for several days in the Upper Peninsula collecting rock samples and scanning hundreds of mineral well records preserved at EGLE's repository near Harvey. We are grateful to Melanie Humphrey for her help on this project. We will use these

materials in critical mineral research, student education, and K-12 Outreach.

We welcomed visits by Con. Fred Upton and Sen. Gary Peters, who learned about geological samples and data preserved at MGRRE.



(left to right) October, 2019, WMU VP Terri Goss Kinzy, Sen. Gary Peters, WMU VP Jeffery Breneman, MGRRE director Bill Harrison, and WMU Pres. Edward Montgomery

Working in the snow last November, we brought some very dark data into the light. Bill, Jennifer, Linda, graduate student Mohammed Al Musawi, and industry friend Hollis Thomas removed 67 boxes of whole cores from a crawlspace under a building and brought them back to MGRRE. Although many of the core boxes were badly deteriorated, most of the cores retained written footage or analysis numbers. We are now working with those numbers to accurately recover all the data. We are grateful to Hollis for arranging this core donation to MGRRE, and for all his “heavy lifting” during the move.

Giving Opportunity

IN EARLY 2021, WE WILL BE EMBARKING ON A CAMPAIGN TO PURCHASE THE PROPERTY THAT HOUSES THE MGS AND MGRRE FACILITY. ADDITIONAL FUNDRAISING WILL TARGET SUSTAINABLE OPERATIONS OF BOTH UNITS. STAY TUNED FOR UPDATES!



This was the first year since 1993 that we could not conduct a PTTC workshop. We were all set with 12 speakers and many generous donors. In late March, as people started to register, we had to cancel the workshop as the Governor released health guidelines for the pandemic. We hope to offer the workshop, in partnership as usual with MOGA, in April 2021.

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

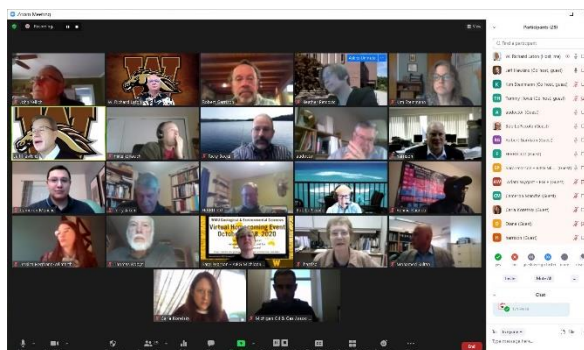
Once again, we ask for your help in contacting your legislators to ask for their support to secure on-going funding for our work at MGGRE and the Michigan Geological Survey. More than half the cores, samples and data that we archive here were acquired since we became part of the Survey—so those materials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

Alumni Notes

Virtual Homecoming 2020

On the weekend of October 16-17, the Alumni Advisory Council held the first-ever fully virtual homecoming weekend. A truly different experience to be sure – no football, no dinner, and no visits to the department. But thanks to

the amazing work of the organizing committee, we had two full days of virtual student, staff, faculty, and alumni fun.



The weekend kicked off with the council meeting, including a visit from Dr. Carla Koretsky, Dean of the College of Arts and Sciences, and a presentation on the status of the department by Dr. Heather Petcovic, the new chair. We heard updates from MGS and MGRRE and discussed the department's fundraising priorities.

Fourteen graduate students participated in the afternoon's Student Research Showcase, with cash prizes for best poster and best talk awards provided by donations from Council members. Congratulations to Ross Helmer (MS Best Poster), Katharine Rose (MS Best Talk), Kristen Foley (MS Best Talk), Katherine Dvorak (PhD Best Poster), Mohammed Al Musawi (PhD Best Talk), and Guzalay Sataer (PhD Best Talk) on their awards.

We wrapped up the afternoon with a presentation by Dr. Robert LoPiccolo, the 2020 Alumni Achievement Award recipient. You can learn more about Dr. LoPiccolo's accomplishments at <https://wmich.edu/geology/alumni/alumni-awards>. Happy hour and trivia night wrapped up Friday evening.

On Saturday morning, Kyle Patterson hosted a group of recent alumni who each discussed their geologic careers in industry, government, and higher education. Many thanks to the panelists who shared their career paths, career advice, and personal stories with our current students.

Adam Wygant, Michigan's State Geologist, gave an overview of his own career and the current status of geologic employment in Michigan over the lunch hour. And for those wondering what it is like to take an online course or participate in a virtual field trip, Dr. Johnson Haas demonstrated his outstanding virtual teaching materials, which include his own YouTube geology channel,

Thanks to Tom Howe's ingenuity, we were able to hold a virtual version of our traditional raffle, and we hope the winners are enjoying their new rock, mineral, and fossil specimens. Virtual meet and mingle and a showing of Galaxy Quest capped off the weekend. Don't forget to pick up your newly re-designed challenge coin!

We extend a hearty thank-you to everyone involved, and want to especially acknowledge the hard work of Council President Jeff Hawkins and the event organizing committee: Dr. Richard Laton, Kim Steinmann, Bill Steinmann, Sara Pearson, Kyle Patterson, and Tom Howe.

Meet a new alumni: Hannah Pankratz, Ph.D.



I work on solving geological and environmental hazards through remote sensing and geophysical techniques. I am in the ESRS lab with Dr. Sultan. I will graduate in the Fall of 2020 and am currently a visiting professor at Grand Valley State University.

We love to hear from you! We encourage alumni to send us updates at any time – please use the update form on our website: <https://wmich.edu/geology/alumni/update>.

In remembrance: Dr. Dick Passero



Dear Friends and Alumni, we are saddened to let you know that WMU Emeritus Professor of Geology Dick Passero has passed away from COVID-19 on Friday, April 3 at Yale University. Our deepest condolences go out to his family, friends, and all of us who have known and worked with him.

Tribute to Dr. Richard N. Passero As presented by Nicholas Pogoncheff (MS Environmental Earth Sciences, 1982) September 15, 2015 Western Michigan University Department of Geosciences 50th Anniversary Rood Hall Auditorium, Kalamazoo, Michigan

In tribute to our Dear Dr. Passero



Dr. Passero is the quintessential model of a successful, extraordinary, and inspiring professor, mentor and colleague for all of us gathered here this weekend to commemorate the Department of Geosciences 50th Anniversary, and to pay special tribute to Dr. Passero for being instrumental in the success of our many professional careers as groundwater and geoscience professionals. Dr. Passero was my thesis advisor from 1979 through 1982, and during that time and through recommendations upon graduating, influenced the beginning of my professional career as a consulting hydrogeologist in Northern California. Your guidance has been magnificent in so many ways. I express gratitude for your vision in providing a graduate program to study contaminant hydrogeology and never ending motivation and entrepreneurial spirit – it was non-stop every day - from academic classes to the UIC program - to research, field work, and reporting for groundwater studies throughout Kalamazoo County – often times, all in one day. Do you remember constructing the prototype seepage meter to measure flux between groundwater and the pond at the KL Landfill, or when a pocket of methane gas was encountered while drilling to install groundwater monitoring wells at the Cork Street Landfill and the PVC well casing shot straight up skyward, soaring – we opened our wings and learned to fly. And to you Dr. Sauck, the magic guidance you provided in the field and classroom is forever precious as well. Within our program there was never time for defeat or criticism, rather a path forward to the next project or activity of the day, week, or month. Dr. Passero, if our Nation's Congress

were aware of the many ways in which you embraced the essence of the Clean Water Act of 1972 and subsequent planning and implementation, you would not only be a hero of ours in this Geology Department, but a National hero as well. Your entrepreneurial spirit is forever and far reaching, and for those of us assembled in this room, including: former graduate students, former and current faculty (including Dr. Straw), and my life-long friends and colleagues Mike Wireman and Kevin Kincare, your vision has been instrumental in achieving both successful and gratifying professional and academic careers. Just look around the room to see the admiration (love) and respect for all you have accomplished and provided for us. Thank you from all of us for enriching our lives, and the lives of our families.



From Mike Wireman, Email sent April 6, 2020 This is such sad news. It is very hard to accept. Dick was my mentor and a great friend. He was incredibly influential in my education and in my career at EPA. I think I was his first grad student with a hydrogeology focus. I remember he and I putting in three groundwater monitoring wells by hand in a cornfield in Schoolcraft Cy. - before the Dept had any field equip. He spent hours with me in the field -we installed the wells with a tripod, a fence post driver and a drive point. I also remember that he hired Nick Pogoncheff and I to paint his house - 2 times! The house really did not need to be painted -but Nick and I needed the money. Nick Pogoncheff, Kevin Kincare and I were very engaged in the EPA UIC grant that Dick and Tome Straw managed. It was a great experience for "young bucks trying to make their way in the word" as

Dick would say. I remember the old house that the grant rented from the University where the UIC project was conducted - a very short walk to the Knollwood Tavern. I also recall that Dick was a good friend to Caspar Cronk - a prof in the Department for a couple of years. Caspar was not a typical professor type and had some troubles -but Dick always supported him. I also recall visits Dick made to Boulder when my daughter was very young and we would walk along the Boulder Creek path - he was very interested in the Boulder Creek bike/hike trail through the City and always wanted Kalamazoo to open up the River in a similar way. While I was at EPA I had the good fortune to hire Dick to help us write an ASTM guide on Groundwater Vulnerability Assessment Methods. We always tried to play golf when he visited - he was an avid golf fan. I'm so glad we were able to honor Dick at the Department's 50-year anniversary ceremony. I fully support the suggestions for an Endowment or Scholarship fund in Dick's name. I will miss him and will always be grateful for his friendship.

From W. Richard Laton, email sent April 6, 2020 Dr. Passero was a gentleman, mentor, friend and educator. I doubt that many of you know that Dick was the reason we had a blimp! In purchasing the blimp for my coastal research, Dick said I needed to go to elementary schools and teach both teachers and students about environmental remote sensing (which I did and enjoyed greatly). Also, I can thank Dick for teaching me how to use a drilling rig (I almost killed Dick in Cass County while drilling once in the snow - will leave the full story to different time). I had the pleasure of working with Dick on his last field hydrogeology camp. He never stopped teaching or learning. I was glad that he came to the 50th, so many of us had the opportunity to thank Dr. Passero in person. He will be missed by us all.



From Alan E. Kehew, email sent April 6, 2020 That is devastating news. He put his heart and soul into this department when he was here. In addition to Dick's scientific contributions, he had interests in many other areas. I remember Tom telling me that Dick was the quarterback of his high school football team. In retirement, Dick became a very accomplished painter. He and Ginny spent a weekend with my ex and I in Maine a few years ago and when we took a few day trips to scenic areas along the coast, Dick checked out every gallery that we saw (Maine has a lot of them). More recently, he told me that he had had his first showing at a gallery in Connecticut. What I remember most about Dick was his determination whether it was putting in wells in the field, working with students, or working on a paper. He would never give up on something until it was done right, no matter how long it took.



From Ron and Chris Chase, email sent April 6, 2020 I am saddened to hear of Dick's passing. Dick was a true gentleman who cared about people and was always available to help them in any way possible, whether their

problems were academic or personal. His wisdom and enthusiasm were major influences in the direction of the early department's teaching and research. His contributions to the department, and to humanity, were a never-ending look at possibilities and ways of getting things done. His role in the establishment of the hydrogeology program is certainly his most visible contribution. Equally honorable was the mentoring of his many students in the classroom and in one-on-one discussions. It was a privilege to call Dick my friend. He was always available to be a sounding board professionally and personally. Chris and I were honored when he served as the Best Man at our wedding. We will truly miss him. Our hearts and prayers go out to Ginny, Kathy, and family. A wonderful person has passed away.

From Bill Sauck, email sent April 6, 2020

What terrible news. Dick was a pillar of the department for a long time. As others have noted, he was instrumental if not in the lead of getting all these things started: earth science education, environmental geology, hydrogeology, Institute for Water Sciences, the GEM program, as well as always giving valued counsel in meetings. Kelly and I have passed through Madison, CT regularly on our way to visit my two daughters who live further east, and have always stopped to visit Dick and Ginny, sometimes for a day, but at least for a meal together. Last time, instead of going to a favorite restaurant, they both collaborated and prepared a wonderful gourmet dinner that we will never forget. Our hearts go out to Ginny, their daughter, and granddaughter (who Dick had taken many times to Disney in Orlando). Dick, a great conversationalist, was always interested in a wide range of topics, including hearing news of our Department. We are sad that he was taken so early by this terrible disease and offer our deepest condolences to Ginny.

From Duane Hampton, email sent April 6, 2020 This is a true loss. Dick is responsible, along with Tom Straw and Lloyd Schmaltz, for the establishment of our department's reputation in environmental sciences and hydrogeology, including creating our summer hydrogeology field course. He was a principal figure in

attracting an EPA grant in the late 1970's to study the suitability of Michigan's aquifers for deep waste injection wells, which resulted in funding many graduate students and in the department putting together and publishing the Hydrogeologic Atlas of Michigan. Along with Tom, Dick is primarily responsible for our department's extensive curriculum in applied water sciences. He and Tom attracted state funding of \$200K/yr for 5 years for our program, which allowed the department to hire Al Kehew and me. He attracted grant funding from the W. K. Kellogg Foundation that established a Groundwater Education in Michigan (GEM) center at Western that persisted well beyond the initial grant's expiration due to statewide respect for Dick's ability to do quality applied research and outreach. Dick took an existing design for an aquifer teaching tool consisting of two parallel glass panes 1 inch apart filled with sand and clay layers and developed the modern design for a robust teaching tool used everywhere to demonstrate groundwater flow to fascinated young students. He created a geology student group to build these models cheaply in Rood Hall for resale to K-12 schools, and workshops and videos to train teachers to make their own even more inexpensively. He created the Institute for Water Sciences at Western which hired R.V. Krishnamurthy and Michael Barcelona. What Dick did was a lasting testament of his commitment to creating a better world for all of us in Michigan and beyond. There is a lot more to his story. It exemplifies the idea that there is no limit to what a person can accomplish if they don't insist on getting acclaim for all of it. I miss him and hope his wife Virginia and daughter are OK.

From Linda Harrison, email sent April 6, 2020 Dick Passero made such a contribution to this department and to all of us. In Dick's Christmas card last year, he mentioned he had been spending the last five years working to convert an historic old school building into a community center. He said he was still painting and playing golf and wished he were in Florida playing year-round. Let me quote from his card: "Hope the year has been good to you and yours, and our sympathies to those whose lives have been touched by sadness. Draw some comfort

from this season for remembering the good times." We will remember the good times with Dick--how he was a wonderful friend and teacher, worked with other faculty members to establish the hydro program in our department, and made a lasting contribution. He is sorely missed.

From John Yellich, email sent April 6, 2020

Dick Passero was at WMU when I was a graduate student in the Department. Dr. Passero's initial role was establishing the "first" Michigan Earth Science Teachers program where half the graduate students and many undergraduates in the late 60's were graduating with Earth Science teaching certificates. This was the foundation for the WMU Earth Science Teaching program that produced hundreds of Undergrad and Graduate students to fill the required High School Earth Science programs. It was later when Dick Passero took his sabbatical and went to California to study hydro-geology and make WMU the premier hydro program that was copied by many other Universities, but their programs were not the caliber of the WMU program as you have summarize so well. Lastly, for some of us he was a friend while we were in school who will be missed, and it was great that he attended the 50th anniversary function. All our prayers are for his family and for those of us who have memories of being mentored directly or indirectly by Richard Passero.

From Jeff Hawkins, email sent April 6, 2020 Thanks Linda for sharing this information. Dr. Passero was a great mentor and professor. I have many wonderful memories with him in the field and in the lab. Not only was he extremely intelligent and thoughtful, he was a gentleman and always concerned about the students and their future. He will be missed; it would be great to find a way for his legacy to live on.

From Sara Pearson, email sent April 6, 2020 Very sad news. Deepest sympathy and prayers for strength and safety for his family, friends, and all whose lives he has touched. May everyone be comforted by memories of him, what he stood for, and how he influenced where we all are today. He was dedicated to the

department, the students, and was a genuinely good-hearted person and role model.

From Ron Parker, email sent April 6, 2020

Thank you everyone for sharing all your short wonderful stories about Dr. Passero. Being an early to mid-1970s Geology student, Dr. Passero was instrumental in my choosing the geosciences as a career. When I was a youngster growing up in Kalamazoo, I asked my mom which of us four children were her favorite. She said that all of you kids are my favorite. I did not understand how this could be. In reflecting this morning about Dr. Passero as all your emails come in, I realize now that he was one of my favorite professors. I now understand what my mom was saying.

From Diana Morton Thompson and Paul Daniels, email sent April 6, 2020 Paul and I are so shocked and saddened by the news on Dr. Passero. Truly a huge loss for so many of us on both a personal and professional level. You all have been so articulate in your comments that we have very little to add except to say how much Dick inspired us. No matter how steep the hill or how bureaucratic the situation, Dick never stopped trying to make kind and positive differences in the lives of communities and individuals. Now it is up to each one of us to be sure that we carry forward his spirit and legacy to help make the world a better place. From

From Lloyd J. Schmaltz sent April 10, 2020

I was greatly saddened to learn of Dick's passing. When I first hired Dick, I was impressed with his desire to work with students in Earth Science Education. He developed that program into an important part of the Geology Department's focus. Western's Teacher Education program in Earth Science became well-recognized in Michigan. As already noted by his colleagues and students, Dick was responsible for establishment of the Department's Hydrogeology program, which is currently greatly respected. Dick's contributions became a cornerstone in the Department's offerings and gave recognition to Geology's program among Western Michigan University's science departments. I greatly respected Dick for his hard work and dedication

to his students. He will always be remembered, and I will miss him.

Giving Opportunity

WE ARE CURRENTLY RAISING FUNDS TO SET UP A NEW ENDOWMENT IN HONOR OF DR. PASSERO. WE HAVE RAISED ABOUT \$10,000 AND OUR GOAL IS \$30,000. PLEASE CONSIDER CONTRIBUTING TO THE PASSERO FUND, WHICH WILL SUPPORT STUDENTS INTERESTED IN HYDROGEOLOGY. FOR MORE INFORMATION, CONTACT KATHY WRIGHT (KATHRYN.WRIGHT@WMICH.EDU).

2019-2020 Faculty, Staff, and Student Accolades

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Awards and Scholarships:

Western Michigan University Named Term-Limited Professorship, 2020-2023: Dr. Matt Reeves

WMU All-University Masters Research and Creative Scholar Award: Tanten Buszka

Department-Level Doctoral Research and Creative Scholar Award: Brooks Ryan

Department-Level Masters Graduate Teaching Effectiveness Award: Katharine Rose

Department-Level Doctoral Graduate Teaching Effectiveness Award: Mabossani (Romeo) Akara

Geosciences Graduate Student Scholarship: Joe McGuire

Douglas Daniels Scholarship: Kyle Knaub

Envirologic Technologies Scholarship: Mary Griffith

Lauren Hughes Scholarship: Mary Griffith

The Roger and LuAnne Steining Geology Scholarship in Honor of Dr. Lloyd Schmaltz: Sophia Calhoun, Ariel Martin, and Zander Sorenson

New Grants:

Caruthers, Andrew: National Science Foundation, \$53,402, *Collaborative research: Multi-disciplinary investigation of the links between volcanism, marine redox, and mass extinction during the Late Triassic and Early Jurassic*

Gillespie, Robb: US Geological Survey, \$16,947, *Geological Mapping of the Charlotte, Chester, Hoytville and Needmore 7.5 Minute Quadrangles*

Harrison, Bill: Battelle Memorial Institute, \$94,147, *Chemically Enabled CO₂-EOR in Multi-Porosity, Hydrothermally-Altered Carbonates in the Southern Michigan Basin*

Harrison, Bill: Battelle Memorial Institute, \$61,279, *Regional Initiative to Accelerate CCUS Development*

Harrison, Bill: US Geological Survey, \$77,374, *Preserving paper well records and thin sections by converting to digital format and mapping depth to bedrock in Michigan UP*

Kaczmarek, Steve: Exxon Mobil Research Qatar, \$120,000, *Phase III: Diagenetic control on rock properties in Eocene limestones and dolostones in Qatar*

Reeves, Matt: City of Kalamazoo, \$53,424, *Hydrogeological and Geochemical Evaluation of the Spring Lake Valley Watershed*

Sultan, Mohamed: Ministry of Municipality and Environment of Qatar, \$137,219, *Continuous Monitoring of Land Deformation in Qatar: A Radar Interferometric Approach*

Sultan, Mohamed: NASA, \$125,000, *Monitoring Deep Aquifer Response to Climatic Variability Using GRACE Data*

Yellich, John: US Geological Survey, \$137,939, *STATEMAP Allegan and Ottawa County mapping, Michigan 1:100,000 scale*

Yellich, John: US Geological Survey, \$100,000, *USGS-EarthMRI - Geologic mapping with Aeromagnetic data, Upper Peninsula Precambrian bedrock Dickinson Co, MI*

Yellich, John: \$500,000, *State Appropriation for the Michigan Geological Survey*

TOTAL: \$1,476,731