

# ***ON THE ROCKS***

*A Newsletter of the Michigan Basin Geological Society*



2020-2021 Edition 3

[www.mbgs.org](http://www.mbgs.org)

November 2020



## **ANNOUNCEMENTS**

**Next MBGS Membership Meeting, December 9th, 2020, 7:00PM:** Colin Plank will present "Environmental Sequence Stratigraphy and the Emergence of the Remediation Geologist in the Midwest".

This will be a virtual meeting. Please RSVP to Jennifer Trout at [jennifer.l.trout@wmich.edu](mailto:jennifer.l.trout@wmich.edu).

**Opportunity for Presenters:** MBGS is seeking presenters for Michigan Basin geologically-related topics for our 2020-2021 virtual membership meetings. Our intent is to host monthly one-hour meetings through May 2021. Meetings will be recorded and available after the initial live presentation. If interested please contact Jennifer Trout at [jennifer.l.trout@wmich.edu](mailto:jennifer.l.trout@wmich.edu) or at (269) 290-4048.

**Volunteer Opportunity:** MBGS is in search of a Vice President, Secretary and Treasurer for the 2020-2021 year. If interested, please contact any one of our executive members.

## **OTHER NEWS**

### **MBGS E.Z. MANOS MEMORIAL SCHOLARSHIP RECIPIENTS ANNOUNCED**

MBGS is pleased to announce two 2020 recipients of the E.Z. Manos Memorial Scholarship. The intent of the MBGS scholarship program is to continue to support and recognize those students that are learning their geologic disciplines while conducting research on Michigan geology.

#### ***PhD winner: Adedoyin S. Adeyiloa, Central Michigan University, \$500***

**Title:** Controls on organic matter abundance and its impact on gas generation, storage and transport in Biogenic Shale gas: Insight from the Devonian Antrim Shale, Michigan Basin.

**Project goal:** To understand the major factors that controls organic matter abundance and porosity distribution in a biogenic shale gas accumulation

#### ***MS Graduate/Undergraduate winner: Sara G. Hayes, Western Michigan University, \$500***

**Title:** Mercury sequestration during the Silurian Period in the Michigan Basin.

**Project goals:** To evaluate the hypothesis that mercury is not a paleo proxy for volcanism and find possible causes of the negative carbon isotope excursions in the Michigan basin.

*Please join us in congratulating Adedoyin and Sara and wishing them well on their continued geologic careers.*

### **MBGS MEMBERSHIP DUES**

MBGS continues to strive to provide a platform for geologist and environmental professionals to connect and offer learning and field trip opportunities. For the 2020-2021 our annual due will increase to \$35 for members. Student dues will remain at \$10. Renewal notices are included in the newsletter and are due by December 30, 2020.

## **December 2020 MBGS Membership Meeting (Free)**

**When:** December 9th, 7:00 PM, 2020 (virtual)

**Presentation:** Environmental Sequence Stratigraphy and the Emergence of the Remediation Geologist in the Midwest

**RSVP:** Jennifer Trout at [jennifer.l.trout@wmich.edu](mailto:jennifer.l.trout@wmich.edu)

### **Biography:**

Colin Plank has over 20 years of experience in the study of geomorphology, stratigraphy, sedimentology, and physical processes in both professional and academic settings. His experience as a senior stratigrapher on remediation projects across the country has led to expertise in evaluating aquifer continuity, heterogeneity, and geometry in a manner that is process-based and geologically defensible.

Mr. Plank has been instrumental in developing and applying Environmental Sequence Stratigraphy (ESS), a system for stratigraphic interpretation based on petroleum industry practice and now widely recognized as an Environmental industry best practice. Using ESS he emphasizes correlations between wells that are based on the use of appropriate modern depositional system analogues, observed relative grainsize trends, and preserved sediment structure in order to link packages of sediment deposited at the same time. In 2015 Mr. Plank received a Letter of Commendation from the Secretary of the Air Force for the impact of his stratigraphic work on site understanding and remediation results at Kirtland Airforce Base, NM.

Colin holds a B.Sc in geology from Grand Valley State University and an M.Sc. in geology from the University of South Carolina. His master's thesis work focused on the petroleum reservoir characteristics and identification of fluvial and marine habitat variations within the stratigraphy of the Pliocene Mississippi delta. After working 5 -years as a coastal geomorphologist and oil spill responder under contract to the National Oceanic and Atmospheric Administration (NOAA), Colin pursued a PhD at the University of Minnesota, completing all coursework, oral and written exams before returning to consulting with a somewhat naïve understanding that time would be available to finish a final thesis composition in between hours spent working and raising his new family. Colin's doctoral research focused on the variability of Holocene mid-continent drought frequency, surface energy budgets, and moisture-balance as recorded by variety of physical and biological proxies preserved in the sediment stratigraphy of lakes in the glacial landscape of northern Minnesota.

Colin's research and professional work have led to expertise in evaluating aquifer continuity, heterogeneity, and geometry in the context of geologically plausible and defensible process-based interpretations of site stratigraphy

### **Abstract:**

There is a recent trend within the environmental industry toward applying advanced stratigraphic analyses to site data, reflecting a growing and perhaps renewed appreciation of the importance of geological controls on the subsurface heterogeneity that dictates remediation success or failure. In 2013 the National Academy of Science Committee on Future Options for Management in the Nation's Subsurface Remediation Effort recognized that at complex sites, restoration within the next 50-100 years was not likely achievable due to *inherent geologic complexities*. The 2017 U.S.EPA publication of Environmental Sequence Stratigraphy (ESS) methodology as a "best practice" for environmental site management (Shultz, M.R., et.al, 2017 EPA/600/R-17/293) was influential in bringing geological thinking and geologically plausible (defensible) visualizations of the subsurface back to the fore as a means of addressing "inherent geologic complexity". The publication has resonated within the industry in part because challenges faced in remediation system design, operation, and optimization are directly analogous to the challenges faced in the development and optimization of recovery of oil field reserves. The advent of the oil field Production Geologist foretold the advent of today's "Remediation Geologist". The objective of this presentation is to briefly review ESS concepts and the state of stratigraphic practice within the environmental and groundwater remediation industry using examples of successful applications in fluvial, glacial, and glacio-lacustrine systems in the Midwest.

## **EVENTS**

*Many organizations have switched to virtual platforms or have cancelled events. We are providing links for your reference. Please visit these sites to learn more about specific events and happenings. If you have an event to share, let us know!*



American Institute of Professional Geologist – Michigan Section – <http://mi.aipg.org/newsletters.htm>

Central Michigan Lapidary and Mineral Society - <http://www.michrocks.org/>

Eastern Section AAPG - <https://www.esaapg.org/>

EGLE Calendar of Events - [https://www.michigan.gov/egle/0,9429,7-135-3308\\_3333---,00.html](https://www.michigan.gov/egle/0,9429,7-135-3308_3333---,00.html)

Flint Rock and Gem - <https://flintrockandgem.org/events>

Michigan Association of Environmental Professionals - <https://www.maep.org/>

Michigan Basin Geological Society – [www.mbgs.org](http://www.mbgs.org)

Michigan Clean Water Corps - <https://micorps.net/about/>

Michigan Mineralogical Society - <https://www.michmin.org/>

Mid-Michigan Rock Club - <http://www.midmichrockclub.com/?Page=1>

Midwest Mineralogical and Lapidary Society - <http://www.mmls.us/>

Society of Petroleum Engineers - <https://www.spe.org/events/calendar/>

### **Event Schedule**

**November 17, 2020:** GVSU AAPG Student Chapter Presentation (in person/limited and zoom), Tony P. Lupo, SM Energy will present “Causes and mitigation: oil and gas drilling disposal water injection-induced earthquake” [RSVP on LakerLink](#) Join Zoom Meeting, Meeting ID: 957 0382 1803, Passcode: 440382  
<https://gvsu-edu.zoom.us/j/95703821803?pwd=TDYxYWZhZOSTxSnhpQWN3WFYyVkhGQT09>

**December 1-3, 2020:** Great Lakes Water Infrastructure Conference, Novi,  
[https://www.michigan.gov/egle/0,9429,7-135-3308\\_3333-500683--,00.html](https://www.michigan.gov/egle/0,9429,7-135-3308_3333-500683--,00.html)

**December 3, 2020:** AIPG Michigan Section Annual Meeting, Weber’s Inn, Ann Arbor, <http://mi.aipg.org/default.htm>

**December 9, 2020:** MBGS Monthly Membership meeting (virtual), Colin Plank will present “Environmental Sequence Stratigraphy and the Emergence of the Remediation Geologist in the Midwest.”

**January 25-26, 2021:** American Association of Petroleum Geologist, Super Basin 2021 (online event),  
<http://superbasins.aapg.org/2021>

**June 14-16, 2021:** Annual Environmental Risk Management Workshop: “The Data Tell the Story” at the Ralph A. MacMullan Conference Center, Roscommon, Michigan.

### **JUST FOR FUN (and inspiration)**

The AAPG Foundation recently awarded Rebekah Kienenberger (Arete Preparatory Academy, Gilbert Arizona) the “Teacher of the Year” award. During her acceptance speech, Rebekah eloquently walks through why she loves geology/earth science and teaching along with touching some of the challenges teachers face in today’s world. The whole video is approximately 10 minutes long and is very inspiring to watch to anyone who shares a love of geology, earth sciences and teaching. The link to the video is found at the bottom of this page:

<https://foundation.aapg.org/teacher-of-the-year-award-recipients>

## ONLINE RESOURCES

- **Michigan Geology Maps Available:**

<https://www.michigan.gov/deq/0,4561,7-135-3304-116670--,00.html>

- **Digital Geology Library Overview:**

[https://www.michigan.gov/documents/deq/GIMDL-Catalog-2010-01-20\\_307979\\_7.pdf](https://www.michigan.gov/documents/deq/GIMDL-Catalog-2010-01-20_307979_7.pdf)

- **GeoWebFace:** [https://www.michigan.gov/deq/0,4561,7-135-3311\\_60700---,00.html](https://www.michigan.gov/deq/0,4561,7-135-3311_60700---,00.html)

- **Digital Geology Library Mining Overview:**

[https://www.michigan.gov/documents/deq/GIMDL-Catalog-2013\\_06\\_22\\_mining\\_425595\\_7.pdf](https://www.michigan.gov/documents/deq/GIMDL-Catalog-2013_06_22_mining_425595_7.pdf)

- **Michigan Geological Survey:** <https://wmich.edu/geologysurvey>

- **USGS Michigan Geological Map Data:** <https://mrdata.usgs.gov/geology/state/state.php?state=MI>

- **CMU, Clarke Historical Library, Michigan Geology:**

[https://www.cmich.edu/library/clarke/ResearchResources/Michigan\\_Material\\_Statewide/Michigan\\_Oil\\_and\\_Gas\\_Industry/History\\_of\\_Michigan\\_Oil\\_and\\_Gas/Pages/Michigan-Geology.aspx](https://www.cmich.edu/library/clarke/ResearchResources/Michigan_Material_Statewide/Michigan_Oil_and_Gas_Industry/History_of_Michigan_Oil_and_Gas/Pages/Michigan-Geology.aspx)



**MICHIGAN BASIN GEOLOGICAL SOCIETY OFFICERS**  
**2020-2021**

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# MBGS PUBLICATIONS

<http://www.mbgs.org/publications.html>

**Historical publications now available on USB Flash Drives". Each USB Flash Drive is 8GB**

Prices include postage, handling and any applicable sales tax.  
Orders for publications should be prepaid in U.S. Funds and addressed to:  
MBGS — Publications  
P.O. Box 14044  
Lansing, MI 48901-4044

## **Historical CD #1: Nine out-of-print publications from 1949 through 1965 and 1998, 2000, \$15**

- The Stratigraphy of Manitoulin Island, Ontario, Canada, June 19-20, 1954
- The Devonian and Silurian Rocks of Parts of Ontario, Canada and Western New York, June 22-23, 1951
- The Traverse Group of the Northern Part of the Southern Peninsula of Michigan, June 16-17, 1949
- The Devonian Strata of the London-Sarnia Area, Southwestern Ontario, Compiled by Erwin C. Stumm, Lewis B. Kellum and Jean Davies Wright, June 9-10, 1956
- The Ordovician Rocks of the Escanaba-Stonington Area, Led by R. C. Hussey, June 2-3, 1950
- The Niagara Escarpment of Peninsular Ontario, Canada, June 18-19, 1955
- Lower Paleozoic and Pleistocene Stratigraphy Across Central Wisconsin, Compiled by C. E. Prouty, Led by L. M. Cline, J. L. Hough and R. F. Black, 1960
- Classic Silurian Reefs of the Chicago Area, by Donald G. Mikulic and Joanne Kluessendorf, June 27, 1998
- Geology of Central Ontario, Canada, 1965

## **Historical CD #2: Four out-of-print publications from 1947, 1959, 1983 and 1991, 2001, \$15**

- Copper Country Field Trip, Michigan, June 20-22, 1947
- Geology of Mackinac Island and Lower and Middle Devonian, South of the Straits of Mackinac, June 12-14, 1959
- Tectonics, Structure and Karst in Northern Lower Michigan, August 1983
- Geology of the Pictured Rocks, Upper Peninsula, Michigan, July 11-13, 1991

## **Historical CD #3: Six out-of-print publications from 1948, 1952, 1990 - 1995, 2001, \$15**

- Pleistocene and Early Paleozoic of the Eastern Part of the Northern Peninsula of Michigan, June 18-21, 1948
- Stratigraphy and Structure of the Devonian Rocks in Southeastern MI and Northwestern OH, June 20-21, 1952
- Lower Ordovician and Upper Cambrian of Wisconsin, May 10-12, 1990
- Guidebook to the Precambrian Geology and Metallogeny of the Central Upper Peninsula of Michigan September 12-13, 1991

## **Historical CD #4: Six out-of-print publications from 1957, 1958, 1961, 1967, 1968 and 1970, 2004, \$15**

- Silurian Rocks of the Northern Peninsula of Michigan, 1957
- Cambrian Geology of Parts of Dickinson and Iron Counties, Michigan, June 1958
- Geologic Features of Parts of Houghton, Keweenaw, Baraga and Ontonagon Counties, Michigan, May 19-21, 1961
- Correlation Problems of the Cambrian and Ordovician Outcrops Areas, Northern Peninsula of Michigan 1967
- The Geology of Manitoulin Island, June 1968
- Devonian Strata of Alpena and Presque Isle Counties, Michigan 1970

## **Historical CD #5: Five out-of-print publications from 1971, 1989, 2001, and Oil & Gas Fields Vol. 1 & 2, 1969 & 1992, 2006, \$50**

- Oil & Gas Fields Symposium, Volume 1, April 1969, 200 pp., maps, illus., second printing with updates
- Oil & Gas Fields Manual of the Michigan Basin, Volume 2, 1992, 520 pp., maps, illus.
- Glacial Geology of Southwestern Michigan, 1989, 53 pp. by A. Kehew, L. J. Schmaltz, and W. T. Straw
- Geology of the Lake Erie Islands and Adjacent Shores, 1971, 65pp., maps, illus. by Jane L. Forsyth
- Glacial Geology of Southwestern Michigan, Landforms of the Lake Michigan Lobe, Southwestern Michigan, 2001, AAPG Eastern Section Meeting Field Trip, 32 pp., maps, illus. by A Kehew and A. Kozlowski

**Historical CD #6: Six out-of-print publications from 1946, 1953, 1963, 1966, 1978 & 1987 plus the Richfield Challenge, 1952 & Tom Knapp's MS Thesis, 2007 \$15.**

- Guidebook for Ordovician Stratigraphy of the Cincinnati, Ohio and Richmond, Indiana Areas, June 12, 13, 1953 by W. H. Shideler and B. T. Sandefur
- Guidebook for Ontario Geological Excursion to Kettle Point – Owen Sound- Waubauskene, June 21, 22, 23 1946 by W. A. Roliff, C.S. Evans and J.F. Caley
- Guidebook for the Stratigraphy of the Silurian Rocks in Western Ohio, May 31- June 2, 1963 by C. H. Summerson, Jane L. Forsyth, Karl V. Hoover and J. R. Ulteig
- Guidebook for Cambrian Stratigraphy in Western Wisconsin, May 21, 22, 1966 by Merideth E. Ostrom
- Geology of the Manitoulin Area, Special Papers #3, September 29, 30 and October 1, 1978 by J. T. Sanford
- and R. E. Mosher
- Middle Devonian Cratonic Carbonates and Shales in Southwestern Ontario, November 14, 1987 by Bruce Wilkinson
- The Richfield Challenge, A Review of the Richfield Developments in Michigan, 1952 by Gordon H. Hautan
- A Theory of Rogers City and Dundee Relationships in Central Michigan, Masters Thesis, 1947 by Tom Knapp

**Historical CD #7: Field Guidebooks from 1962, 1969, 1977, 1980, 1985 & 1988, \$15**

- Silurian Rocks of the Southern Lake Michigan Area, 1962, James H. Fisher, Chairman, MBGS Annual Field Conference
- Studies of the Precambrian of the Michigan Basin, by Harold B. Stonehouse, 1969
- The Geology of the Marquette District: a Field Guide By F. W. Cambray, 1977
- Ordovician and Silurian Geology of the N. Peninsula of Michigan, 1980, R.B. Votaw, 40 pp., illus., maps
- Special Paper #4: Ordovician and Silurian Rocks of the Michigan Basin and its Margins, 1985 K.R. Cercone and J.M. Budai (eds.), 96 pp., illus.
- Upper Keweenawan Rift-Fill Sequence, Mid-Continent Rift System, Michigan, 1988, P.A. Daniels and R.D. Elmore, M.S. Wollensak, ed., 150 pp., illus., maps

**OTHER SPECIAL OFFERS**

- **Historical CD Set - # 1 – 7 (detailed above) for a special purchase price of \$95**
- **NE Lower Peninsula Geological Field Conf., 2004, T. Black, M. Wollensak, On CD \$10**
- **Stratigraphic Lexicon for Michigan, 2001, prepared by MBGS and published by DEQ, \$4**
- **Robert E. Mosher Geological Studies** A lifetime of geological research on Silurian Rocks with John T. Sanford. The disks are organized chronologically and include field work in North America and Europe. 2007, 2 CDs \$35.



## **IN OTHER NEWS**

**LED FIELD LENS AND MBGS LANYARD** The Michigan Basin Geological Society is offering geological field hand lens and lanyards. The field hand lens is a large 21mm lens with a 20X magnification. A pair of white LEDs provides illumination for all those darkened close-up viewing of rocks, minerals and fossils. A case is provided for the field lens with a key to remove the batteries. Batteries are included. The green lanyard has MICHIGAN BASIN GEOLOGICAL SOCIETY printed on one side of the 1" wide webbing. This lanyard is designed with a breakaway buckle clip and detachable keychain for versatile use and comfortable wearing. MBGS is offering the Lanyard/LED Hand Lens and Case combo for \$15 each and the Lanyard alone for \$5 each if picked up at a meeting or field trip. If you request to have your purchase mailed, standard costs for mailing container and postage will apply. Please contact Mark Wollensak at [wollensak@att.net](mailto:wollensak@att.net) to order.



### **GVSU AAPG STUDENT CHAPTER PRESENTATION (FREE)**

#### ***Causes and mitigation: oil and gas drilling disposal water injection-induced earthquakes***

By Tony P. Lupo (B.S., Geology, Grand Valley State University and an M.S., Geophysics, New Mexico Tech)

Tuesday, November 17, 2020

4:30 p.m. - 5:30 p.m. Cook-DeWitt Center (in-person capacity 36, RSVP required) on GVSU's Allendale campus (also live streamed via zoom)

[RSVP on LakerLink](#) [RSVP on LakerLink](#) Join Zoom Meeting, Meeting ID: 957 0382 1803, Passcode: 440382  
<https://gvsu-edu.zoom.us/j/95703821803?pwd=TDYxYWZhOSxSnhpQWN3WFYyVkhGQT09>

Tony currently works for SM Energy (Denver, CO) as their Chief Geophysicist. He manages various technical programs, data science initiatives, and mentors and recruits. Previously, he was Vice President of Geophysics at Fossil Creek Resources (Arlington, TX), worked for Fossil Creek Resources, Samson ResourcesMid-Continent Division, and ConocoPhillips. He has worked on oil and gas plays in West Africa, the Gulf of Mexico, Alaska, and the mid-Continent. He has advanced interpretation, rock physics, and high-resolution seismic acquisition and processing techniques. He also serves on the Board of Directors for the Society of Exploration Geophysicists Foundation and has published papers on topics that include machine learning, seismic acquisition, and seismic reservoir characterization. When not doing geology and geophysics, Tony enjoys mountain biking, reading, camping, hunting, fishing, and terrorizing Denverites in his 1967 Camaro.

### **MDNR CALL FOR 2021 MICHIGAN STATE PARKS PHOTO AMBASSADORS**



Looking for an interesting, creative and unique volunteer opportunity? The MDNR is searching a group of Michigan state parks photo ambassadors.

Photo ambassadors work with the DNR by sharing and curating imagery, as well as providing photos to help the DNR showcase outdoor recreation, state parks, trail and water-based destinations on the [@MiStateParks Instagram account](#) and in other marketing materials.

[Learn more about the ambassador program and find the 2021 application.](#)

*Photo taken at Ludington State Park by 2020 Michigan state parks photo ambassador Sarah Goodwin.*

## HAPPY LITTLE 5K IS BACK APRIL 22-30, 2021!



The [Run for the Trees / Happy Little 5K](#) is back next year (April 22-30) and registration opens up Tuesday, Dec. 1 at 9 a.m.

No matter how you reach the finish line – walk, run or hike – you pick the pace and the place, anywhere outdoors! Everyone gets a newly designed Happy Little T-shirt, a commemorative bib number and finisher's medal (featuring a Bob Ross painting).

Registration is \$34 per person, and every virtual 5K counts. All race proceeds support tree-planting and preservation efforts in state parks.

[Sign up for the pre-registration notification](#) and receive a friendly reminder a week before registration opens.

## AIPG KENTUCKY SECTION IS HOSTING FREE WEBINARS ON ENVIRONMENTAL GEOLOGY WITH AST ENVIRONMENTAL, INC and REMEDIATION PRODUCTS, INC

### November 19th, 2020: Drilling down on the Trap and Treat Approach Part 2 – Petroleum Hydrocarbons Remediation

Food-grade AC inoculated with a specific microbial consortium (plus electron acceptors and nutrients) can expedite remediation of dissolved/sorbed mass and reduce or eliminate LNAPL. This technology functions irrespective of high salinity or TDS. This training will introduce AC-based technologies that have been utilized for projects in many states and internationally. This class of technologies is increasingly popular for overburden and bedrock applications, yet design and application of these technologies remain unfamiliar to audiences everywhere, due to their physical properties (slurry). AC for degradation of petroleum hydrocarbons, LNAPL, fuel oxygenates, alcohols, glycols, and cyclic ethers has grown tremendously worldwide in the past few years. This talk describes the coupling of AC and biological degradation mechanisms to create a synergistic effect that rapidly degrades mass, controls plumes, and does not produce harmful byproducts or create subsurface compatibility concerns (e.g. utilities, building footers). <https://attendee.gotowebinar.com/register/1125073484530814736>

### December 3rd, 2020: Working Smarter, Not Harder, to Characterize Fractured Bedrock

We will consider the use of geophysics (surficial and borehole) to select injection well locations, review rock coring (selection, visual observation, and rock matrix sampling), evaluate borehole geophysical logging and discrete samples (18" interval), and review rock cores for design of a site injection program. Many fractured bedrock sites do not achieve cleanup goals on time or on budget because conventional techniques and technologies to address contaminant flow and bedrock well injection are dated. Most times, the design depicts an incomplete understanding of the location (interval), mass concentration, and mass flux; typically, these are the result of the cost of fractured bedrock site investigation, access difficulties in the subsurface, injection deficiencies in the subsurface, or poor remedy selection. These important characteristics of a fractured bedrock site can be solved. Understanding the geologic controls of a fractured bedrock site, selecting the proper reagent loading, considering reagent persistence, and achieving distribution in the subsurface are key to resolving contaminated fractured rock. This webinar walks through a fractured bedrock RDC process that helps control investigation costs, develops a high-resolution understanding of groundwater and contaminant mass in the subsurface, and refines the final injection plan and equipment necessary to achieve reagent distribution and treatment. Attendees will have a better understanding of the concert of tools critical to understanding a fractured rock environment and have the confidence to speak about and apply these concepts for their clients. <https://attendee.gotowebinar.com/register/2928278051641606928>

### December 10th, 2020: Unlocking the Secrets to Fractured Bedrock Injection

The webinar will focus on the specialized equipment designed for high-pressure rock injection, while depicting the considerations, challenges, and expectations of fractured bedrock injection utilizing a narrow-interval straddle packer injection system coupled with high capacity pumps. This technology is different from many conventional bedrock injection programs that use low-flow or diffusion to address groundwater zones, and places reagent surgically in the subsurface based on the Remedial Design Characterization (RDC). A key to bedrock remediation is to not treat just the highly transmissive zones, but also lower transmissive zones and zones of residual contaminant storage. A combination of custom packers (18" between inflation elements) and a unique bedrock injection unit (flow rates ranging from 50 to 250 gallons per minute and pressure up to 3,000 psi.) allows focused treatment using high energy access to the smaller aperture fracture networks which typically contain more contaminant mass than more transmissive features. Understanding these challenges and concepts has led to the development of custom injection equipment to increase reagent distribution, speed, efficacy, and success for bedrock injection programs. Being able to isolate and treat these zones is a key component to success at difficult fractured bedrock sites. When coupled together with a unique RDC processes and methodology (covered in previous webinar) and high-pressure formational response case histories, there is a higher probability that the design and selected amendments are properly installed into the targeted treatment zones. <https://attendee.gotowebinar.com/register/6113718268448204304>

### December 17th, 2020: The Pre-drill Methodology: Overcoming Unconsolidated DPT Refusal

The injection locations are first pre-drilled to the desired depth using sonic or auger rigs and the evacuated borehole is then backfilled with hydrated bentonite chips or pellets to seal the bore wall. Direct Push Technology (DPT) rigs are then used to push through the bentonite to reach the desired injection depth intervals without compromising the bore seal. This training will introduce attendees to the Pre-Drill methodology, pioneered by RPI Group over a decade ago. Pre-Drill (pre-drilling injection locations) technique is used to bypass zones or achieve depths where DPT refusal occurs in the subsurface, allowing access to these vertical depths with DPT rigs after completion. Examples of zones that benefit from this installation process include gravel/cobble, glacial till, chert layers, caliche layers, breccia layers, stiff clays, weathered bedrock, urban fill, and more. The Pre-Drill process involves advancing sonic or HSA/SSA rigs to targeted depths and then backfilling with a hydrated bentonite-based mixture. Once the backfill has set up, a DPT rig can be pushed through the bentonite mix column and high-pressure injection intervals can commence. This technique has been used all over the United States by AST. <https://attendee.gotowebinar.com/register/8433917600985794832>



