AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS

Northeast Section NEWSLETTER

Winter 2020

As published on 02/11/2020.

Reserve Your Spot Now!
Drone Short Course

Where: Morristown, NJ
When: April 23, 2020

Take a look at what the Section is doing: December Meeting Minutes

What's the oldest impact crater on earth? Find out HERE!

Is there "snow" on the Earth's core?

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AIPG Northeast Section Newsletter
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2020 NORTHEAST SECTION SUBCOMMITTEES
(As updated 1/30/2020)

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Screening Board: Charles Rich (Chairperson); Don Bruehl, Carol Graff, William Penn, Daniel Toder, Andrew Tolman, William Prehoda

2020 EXECUTIVE COMMITTEE MEETING SCHEDULE:

January 6th
March 9th
May 15th (Spring Meeting on-site)
July 13th
September 14th
October 9th (Fall Meeting)
December 7th

Meetings are typically held from 4:00 to 6:00 pm via teleconference.

(End)

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ENVIRONMENTAL CONSULTANTS

DRILLING

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ENVIRONMENTAL FIELD SERVICES

(End)

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Presidential Ramblings – Winter, 2020

Hello Northeast Section and Happy New Year to all! The executive committee really hit the ground running this January. We're currently in the process of evaluating all 19 applications received for the Angelo Tagliacozzo Memorial Geological Scholarship and getting all of the ducks in a row for the two short courses we aim to host this year! I do believe that 2020 will be a fun and exciting year for the Section.

This newsletter marks the start of my second term as Section president. Not that I'm counting the days or anything. I'd like to thank my colleagues Laurie Scheuing, Brandon Tufano, and Chris Brown for staying on the committee for another term. Many of you exercised your right as Northeast Section members and voted them in last November

(Ramblings continued on page 14)

Environmental Consultants

SAVE THE DATE!

Thursday, April 23, 2020
Short Course – Morristown, New Jersey

RUTGERS UNIVERSITY | NEWARK
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American Institute of Professional Geologists - Northeast Section & Meadowlands Environmental Research Institute

The Use of Unmanned Aerial Vehicles

in Environmental Site Characterization

Are you looking for an interesting way to learn about drone data collection on air quality, land use, water characteristics, and vegetation status while receiving four (4) LSP/LSRP CEUs?!

This course will incorporate classroom learning followed by an interactive field demonstration of a real time drone data collection mission!

Come join us to watch live demonstrations, connect with associates, and learn the cutting edge data resources that drones can provide.

LOCATION: WSP Office at 412 Mt. Kemble Ave, Morristown, NJ
COURSE AGENDA (11:30-4:30 PM):

11:30- 12:00	Registration (Lunch Provided)
12:00 - 12:15	Welcome, introduction, and review of course objectives
12:15 - 1:00	Overview of flight principles and equipment; regulations and licensing requirements; safety considerations; and pre-flight planning.
1:00 - 1:45	Image acquisition in dangerous areas. Site characterization support with high-resolution photos; ortho-mosaics, video and terrain models.
1:45 - 2:00	Break
2:00 - 2:45	Application examples; industrial property assessment infrastructure evolution, flood control, land cover/use, mining residues.
2:45- 3:45	Field demonstration with data acquisition and post-processing data integration (LiDAR and GIS).
3:45-4:15	Review and summary with Q&A

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(Ramblings continued from page 11)

and I thank you for your participation.

Back at home, my family and I are hunkered down for the winter. And by that I mean enjoying both the snow and occasional 55-degree days. When my son turned seven in December, I gifted him a rock tumbler and we immediately got to polishing. Just after the New Year we completed our first batch of rocks. It's important to know that this is something that I've wanted to do all of my life and that I'm only now getting around to doing it. And it brings me immense joy to watch my children engage in this process (or any STEM related process, really).

Upper right moving counter-clockwise – increasing level of polishing over time.

Anyhow, I hope you enjoy this newsletter! Many thanks to Brandon Tufano for doing such a good job putting it and all of the others together.

Until the next newsletter,

Michael

(End)

(Save the Date continued from page 13)

The Use of Unmanned Aerial Vehicles in Environmental Site Characterization

The use of unmanned aerial data collection devices (drones) has become a standard tool for many scientific disciplines. Drones are being and will be used to support site remediation projects in numerous ways including:

- Accessing potential areas of environmental concern within complexes or sites that are inaccessible either due to structural issues of for other health and safety reasons;
- Collection of baseline air emissions data from disposal sites (e.g. methane discharge from landfills) or routine monitoring of air emissions during or after remediation; and
- Tracking of stressed vegetation, surface water runoff pathways, and thermal signatures indicative of subsurface reactions (e.g. tracking of ISCO injection efficiency).

This course will provide a more comprehensive understanding of the mechanics of their operation, the regulatory restrictions associated with drone usage, and the type of data packages they can generate. This will allow licensed professionals to make informed decisions on when or if drone collected data would be useful and how those data will be processed.

The course will be led by Dr. Francisco Artigas and Mr. Michael Stepowyj. Dr. Artigas is the current director of the Meadowlands Environmental Research Institute (MERI) and research associate professor at Rutgers University. Stepowyj is a GIS specialist at MERI and has a FAA Part 107 Unmanned Aircraft Systems Commercial Pilot License.

Register Now Online at http://ne-aipg.org/meetinginfo.php

Registration will open March 1st

Course Registration: $225 (includes lunch and afternoon snack)

Register early to guarantee your spot! Seating for this event is limited!!

CEU Credit Includes:
4 LSRP (NJ) technical credits hours (Course No. 2019-044)
4 LSP (MA) technical credit hours (Course No. 1664)
4 PD hours by North Carolina Board for Licensing of Geologists (Approval Code 180128)
Qualifies for professional development hours for licensure in Pennsylvania and New Hampshire

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~ Please watch for more details coming soon ~

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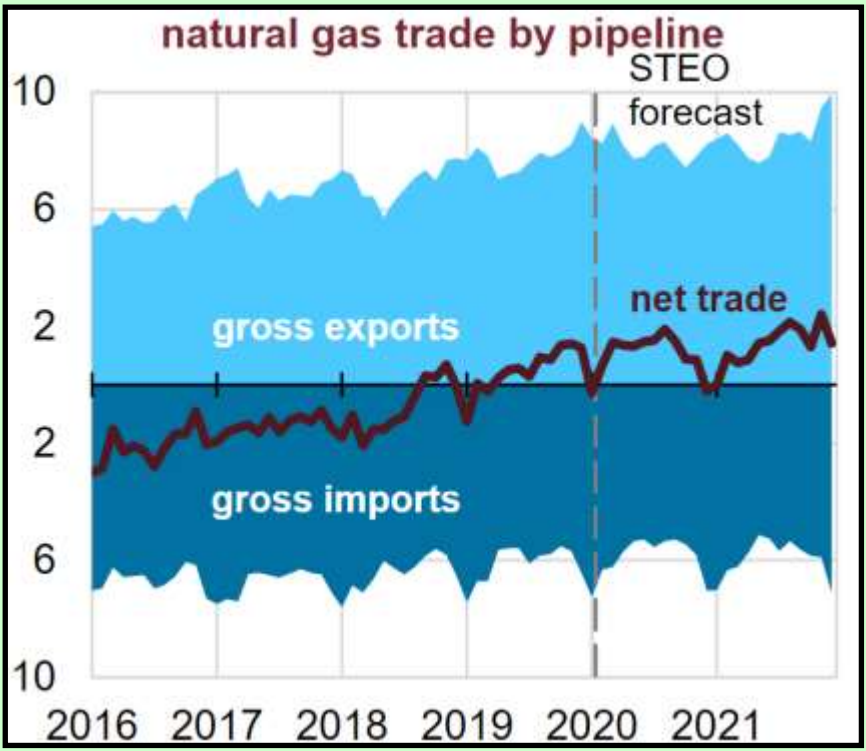
EIA expects U.S. net natural gas exports to almost double by 2021

In its Short-Term Energy Outlook (STEO), released on January 14, the U.S. Energy Information Administration (EIA) forecasts that U.S. natural gas exports will exceed natural gas imports by an average 7.3 billion cubic feet per day (Bcf/d) in 2020 (2.0 Bcf/d higher than in 2019) and 8.9 Bcf/d in 2021. Growth in U.S. net exports is led primarily by increases in liquefied natural gas (LNG) exports and pipeline exports to Mexico. Net natural gas exports more than doubled in 2019, compared with 2018, and EIA expects that they will almost double again by 2021 from 2019 levels.



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The United States trades natural gas by pipeline with Canada and Mexico and as LNG with dozens of countries. Historically, the United States has imported more natural gas than it exports by pipeline from Canada. In contrast, the United States has been a net exporter of natural gas by pipeline to Mexico. The United States has been a net exporter of LNG since 2016 and delivers LNG to more than 30 countries.

In 2019, growth in demand for U.S. natural gas exports exceeded growth in natural gas consumption in the U.S. electric power sector. Natural gas deliveries to U.S. LNG export facilities and by pipeline to Mexico accounted for 12% of dry natural gas production in 2019. EIA forecasts these deliveries to account for an increasingly larger share through 2021 as new LNG facilities are placed in service and new pipelines in Mexico that connect to U.S. export pipelines begin operations.

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Net U.S. natural gas imports from Canada have steadily declined in the past four years as new supplies from Appalachia into the Midwestern states have displaced some pipeline imports from Canada. U.S. pipeline exports to Canada have increased since 2018 when the NEXUS pipeline and Phase 2 of the Rover pipeline entered service. Overall, EIA projects the United States will remain a net natural gas importer from Canada through 2050.

U.S. pipeline exports to Mexico increased following expansions of cross-border pipeline capacity, averaging 5.1 Bcf/d from January through October 2019, 0.5 Bcf/d more than the 2018 annual average, according to EIA's Natural Gas Monthly. The increase in exports was primarily the result of increased flows on the newly commissioned Sur de Texas–Tuxpan pipeline in Mexico, which transports natural gas from Texas to the southern Mexican state of Veracruz. Several new pipelines in Mexico that were scheduled to come online in 2019 were delayed are expected to enter service in 2020:

- Pipelines in Central and Southwest Mexico (1.2 Bcf/d La Laguna–Aguascalientes and 0.9 Bcf/d Villa de Reyes–Aguascalientes–Guadalajara)
- Pipelines in Western Mexico (0.5 Bcf/d Samalayuca–Sásabe)

U.S. LNG exports averaged 5 Bcf/d in 2019, 2 Bcf/d more than in 2018, as a result of several new facilities that placed their first trains in service. This year, several new liquefaction units (referred to as trains) are scheduled to be placed in service:

- Trains 2 and 3 at Cameron LNG in Louisiana
- Train 3 at Freeport LNG in Texas
- Trains 5–10, six Moveable Modular Liquefaction System (MMLS) units, at Elba Island in Georgia

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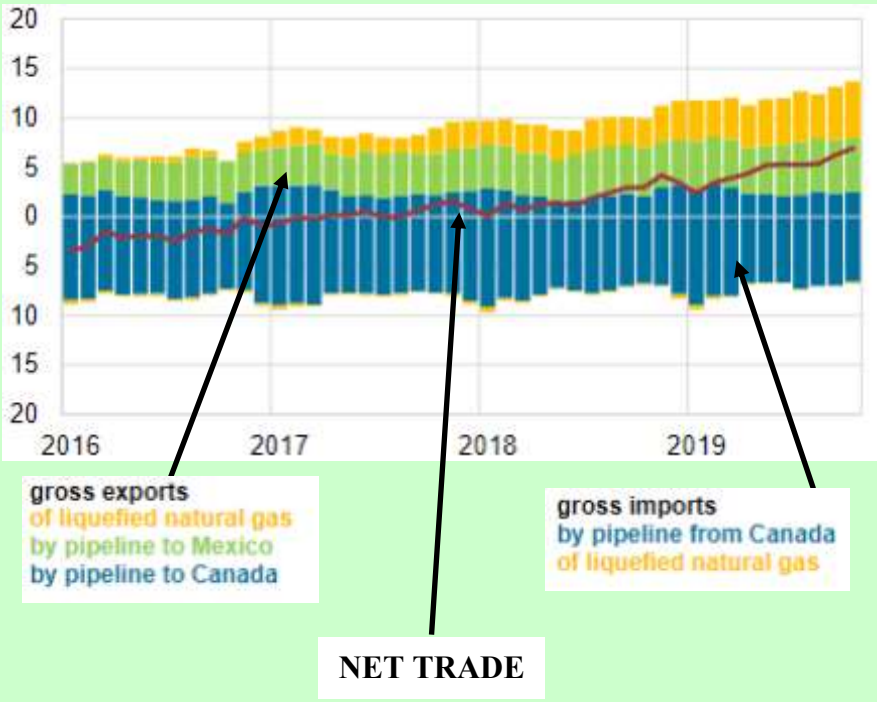
In 2021, the third train at the Corpus Christi facility in Texas is scheduled to come online, bringing the total U.S. liquefaction capacity to 10.2 Bcf/d (baseload) and 10.8 Bcf/d (peak). EIA expects LNG exports to continue to grow and average 6.5 Bcf/d in 2020 and 7.7 Bcf/d in 2021, as facilities gradually ramp up to full production.

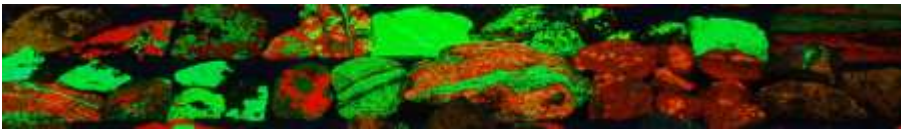
Monthly U.S. natural gas trade (Jan 2016–Oct 2019) Billion cubic feet per day



Source: U.S. Energy Information Administration, Natural Gas Monthly

Principal contributor: Victoria Zaretskaya

(End)



Yar rabubba Impact St ructure

In today's age with so many questions surrounding our climate and it's undeniable change, it is our job to look into the past and determine what may have moderated historic climate shifts and draw what parallels we may. A group of scientists did just that by accurately dating the Yarrabubba impact structure and investigating its timing relative to a shift in global climate.

Modern day Yarrabubba crater.
You can still see the uplifted center peak, all that remains of the once massive complex crater structure in the Western Australia outback.

To determine the exact age of Yarrabubba, Dr. Timmons Erickson of Curtin University and NASA's Johnson Space Center and colleagues analyzed the minerals zircon and monazite that were 'shock recrystallized' by the asteroid strike.

The researchers inferred that the impact may have occurred into an ice-covered landscape, vaporized a large volume of ice into the atmosphere, and produced a huge crater in the rocks beneath.

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(Yarrabubba crater continued from page 25)

"The timing raised the possibility that the Earth's oldest asteroid impact may have helped lift the planet out of a deep freeze," said Curtin University's Professor Chris Kirkland.

"Yarrabubba, which sits between Sandstone and Meekatharra in central Western Australia, had been recognized as an impact structure for many years, but its age wasn't well determined."

"Now we know the Yarrabubba crater was made right at the end of what's commonly referred to as the early Snowball Earth — a time when the atmosphere and oceans were evolving and becoming more oxygenated and when rocks deposited on many continents recorded glacial conditions."

The study authors noted the precise coincidence between the Yarrabubba impact and the disappearance of glacial deposits.

"The age of the Yarrabubba impact matches the demise of a series of ancient glaciations," Dr. Erickson said.

"After the impact, glacial deposits are absent in the rock record for 400 million years."

"This twist of fate suggests that the large meteorite impact may have influenced global climate."

Numerical modeling further supports the connection between the effects of large impacts into ice and global climate change.

Calculations indicated that an impact into an ice-covered continent could have sent half a trillion tons of water vapor into the atmosphere.

This finding raises the question whether this impact may have tipped the scales enough to end glacial conditions.

"This study may have potentially significant implications for future impact crater discoveries," said Dr. Aaron Cavosie, also from Curtin University.

"Our findings highlight that acquiring precise ages of known craters is important — this one sat in plain sight for nearly two decades before its significance was realized."

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(Yarrabubba crater continued from page 30)

"Yarrabubba is about half the age of the Earth and it raises the question of whether all older impact craters have been eroded or if they are still out there waiting to be discovered."

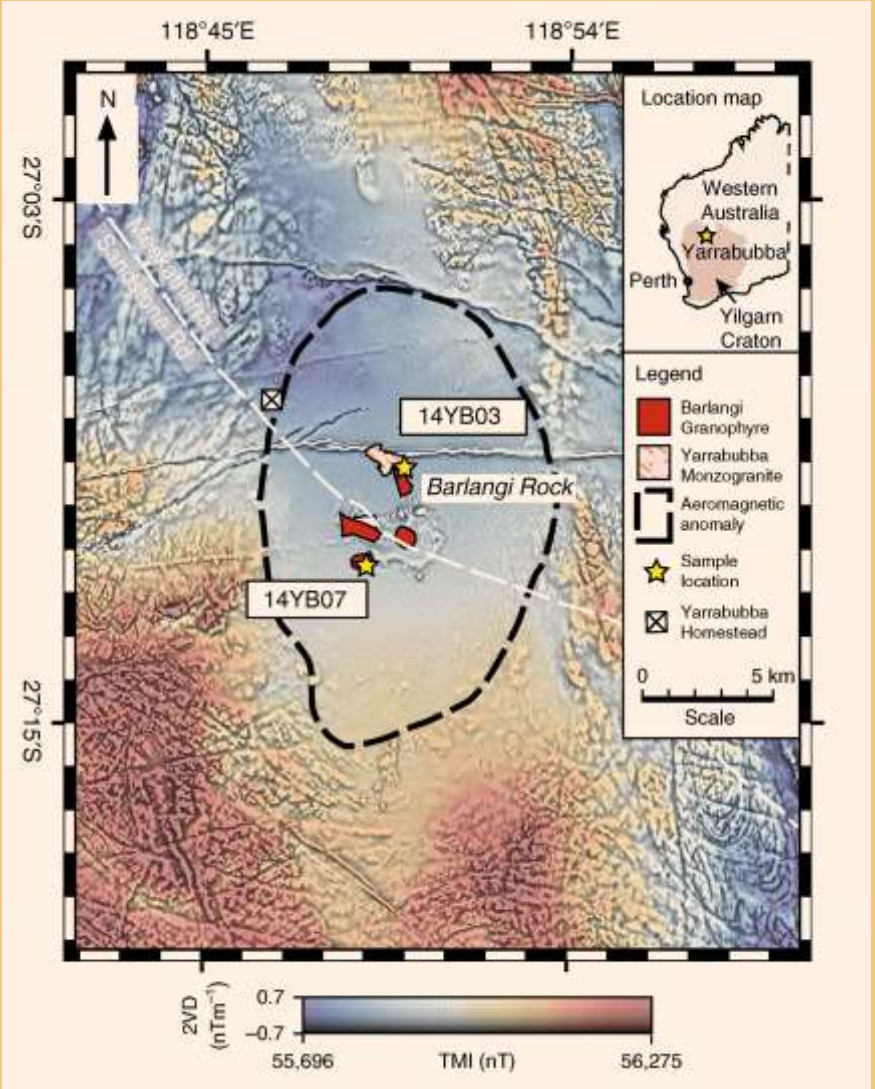

Figure 1: Description on page 38.

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We are always more than willing to
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ideas and experiences
into the quarterly Newsletter!

Submit your ideas to Brandon Tufano
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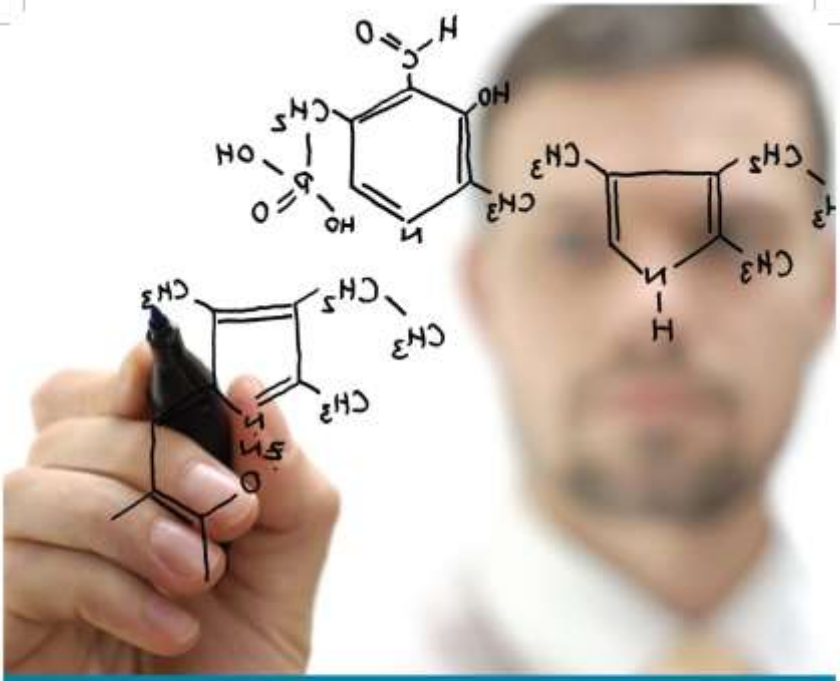
What are the AIPG Purposes?

The purposes of the Institute shall include:

- Advancing the geological sciences and the profession of geology;
- Establishing qualifications for professional geologists;
- Certifying the qualifications of specific individual member geologists to the public;
- Promoting high standards of ethical conduct among its members and adjuncts and within the profession of geology; and
- Representing and advocating for, the geological profession before the government and the general public.



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(Yarrabubba crater continued from page 31)

Composite aeromagnetic anomaly map of the Yarrabubba impact structure within the Yilgarn Craton, Western Australia, showing the locations of key outcrops and samples used in this study. The image combines the total magnetic intensity (TMI, cool to warm colors) with the second vertical derivative of the total magnetic intensity (2VD, grayscale) data. The demagnetized anomaly centered on the outcrops of the Barlangi granophyre is considered to be the eroded remnant of the central uplift domain, which forms the basis of the crater diameter of 70 km. Prominent, narrow linear anomalies that cross-cut the demagnetized zone with broadly east-west orientations are mafic dykes that post-date the impact structure.

Image credit: Erickson et al, doi: 10.1038/s41467-019-13985-7.

Article reproduced from Science News http://www.sci-news.com/space/yarrabubba-crater-08040.html

(End)

DECEMBER 2019 MEETING MINUTES

NE SECTION – AIPG
EXECUTIVE COMMITTEE MEETING
MONDAY, DECEMBER 9, 2019

Distribution:

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Laurie Scheuing	Chris Brown	Brandon Tufano
Dennis McGrath	Jennifer Becker	Adelina Prentice
Dick Young		

Call to Order (4:04 PM)

Secretary's Report

November 2019 – Luanne makes motion to accept, Jessica seconds. Motion passes with no discussion.

Treasurer's Report

October 2019 and November 2019 – The NE Section budget is in good standing. The national meeting income share is shown in deposits, and the usual payables for bankcard and Star Chapter web hosting fees. An increase in Star Chapter fees is possible in the near future. The section just about broke even on the national meeting costs and revenue.

The Angelo Tagliacozzo Memorial Geological Scholarship (ATMGS) fund has had a good month of growth, and the past year has shown a growth by approximately 13%. With the current balance, the fund could provide approximately 12-15k each year without affecting principle.

Correspondence

- Student Chapter Updates: Brooklyn College, SUNY Geneseo, SUNY Binghamton, etc. – No updates on current chapters; a

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(December Minutes continued from page 40)

discussion to reach out to previous points of contact to see if we can reestablish contact with current members.

- Scholarship-related – The deadline for the scholarship passed on the 5th and there are about 18 or 19 applicants with complete applications.

Old Business

- Short Courses – Geophysics & Drone Technology in 2020 – Discussion to combine the Drone Technology course with the Spring meeting (see below), and Jeff will contact the Morristown NJ training center as a possibility for the training courses.

- NE Section Reach-Out to MA, NH, RI, ME – No new updates.

- Scholarship Committee – New Members – With a recent vacancy, Kelly will be assuming a permanent role and has been helping with managing input. Jeff will be serving as a floater, and Michael and Adelina confirm interest to participate. A separate call to orient new members to the application and scoring system is proposed for later in the month.

NE Section – Student Chapter Engagement – No new updates.

New Business

- 2020 ExCom Elections – Candidates were reelected.

- Spring Meeting – 2020 – An offer was received by Milena Cunningham of the New Jersey Licensed Site Remediation Professionals Association (LSRPA) to offer a discount of courses and potentially promote the AIPG Spring meeting in exchange for promoting the LSRPA conference in February. In light of this, the downstate New York and New Jersey area would be the target for the AIPG Spring meeting. A discussion followed on offering the Drone short course instead of a field trip, and the possibility of offering the course to meeting attendees without the course fee, depending on whether they wanted the education credits.

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Drilling

(December Minutes continued from page 41)

Publications

Newsletter – An email from Brandon (not on call) to update the Holiday newsletter is in review.

Advertising Sales Update & Income – Currently in the process of sending invoices for upcoming year to advertisers so they can decide if they want to budget the cost for 2019 or 2020.

Addendum

The meeting schedule for 2020 was distributed prior to the meeting:

January 6

March 9

May 15 (Friday, Spring meeting)

July 13

September14

October 9 (Friday, Fall meeting)

December 7

Motion was made to accept and was seconded.

Dennis brings up the March NE GSA meeting and attendance for representation. Reimbursement was previously a line item but was not included in 2019.

Motion to adjourn was made and seconded.

Adjournment (5:18 PM)

(End)

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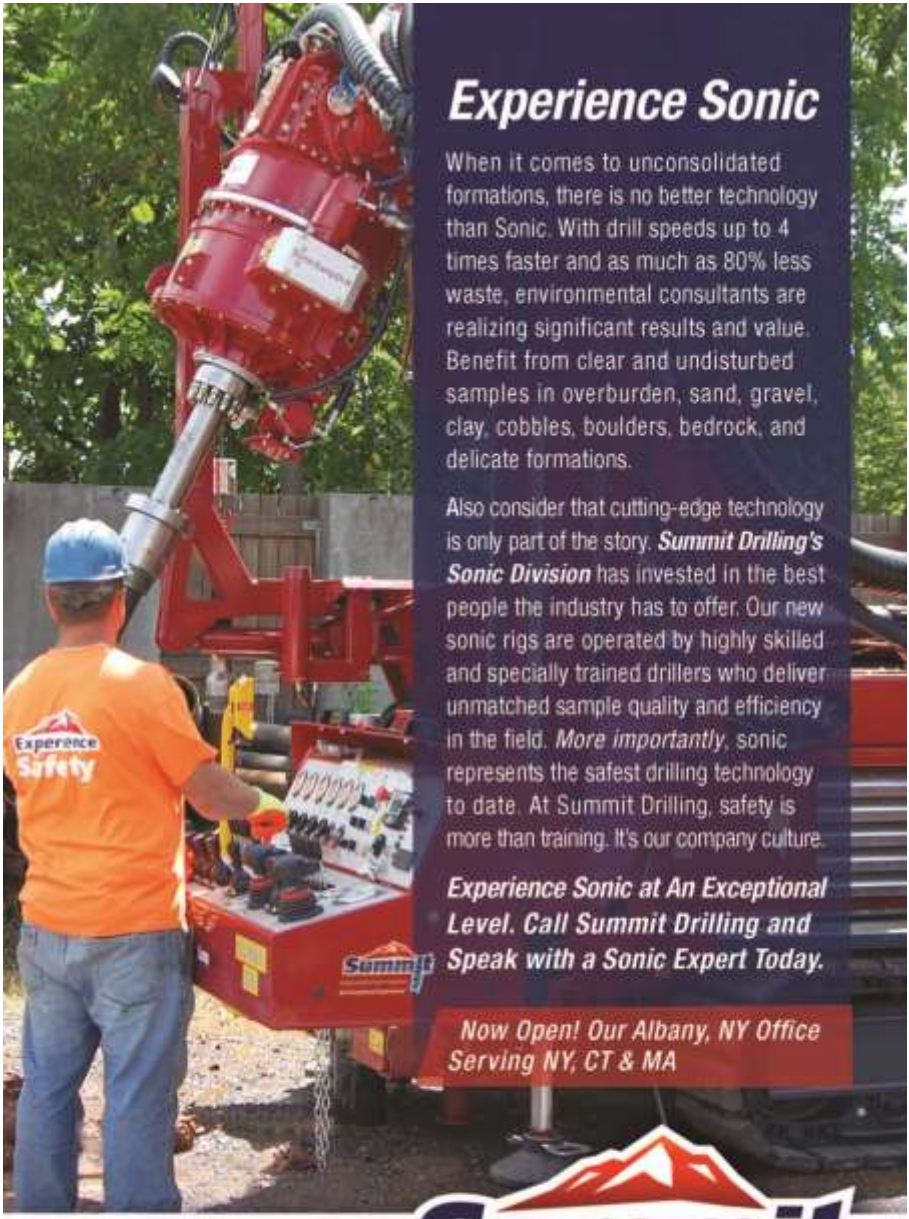

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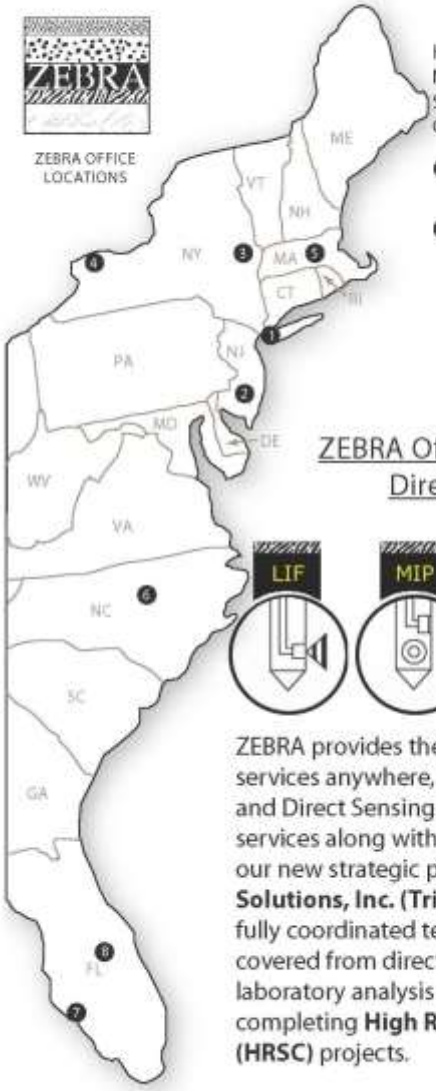

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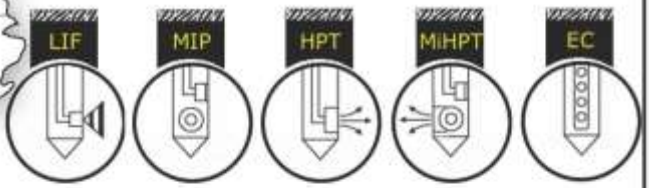

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'Melting rock' models predict mechanical origins of earthquakes

Engineers at Duke University have devised a model that can predict the early mechanical behaviors and origins of an earthquake in multiple types of rock. The model provides new insights into unobservable phenomena that take place miles beneath the Earth's surface under incredible pressures and temperatures, and could help researchers better predict earthquakes -- or even, at least theoretically, attempt to stop them.

For three decades, researchers have built machines to simulate the conditions of a fault by pushing and twisting two discs of rock against one another. These experiments can reach pressures of up to 1450 pounds per square inch and speeds of one meter per second, which is the fastest underground rocks can travel. For a geological reference point, the Pacific tectonic plate moves at about 0.00000000073 meters per second.

"In terms of ground movement, these speeds of one meter per second are incredibly fast," said Manolis Veveakis, assistant professor of civil and environmental engineering at Duke. "And remember that friction is synonymous with resistance. So if the resistance drops to zero, the object will move abruptly. This is an earthquake."

In these experiments, the surface of the rocks either begins to turn into a sort of gel or to melt, lowering the coefficient of friction between them and making their movement easier. It's been well established that as the speed of these rocks relative to one another increases to one meter per second, the friction between them drops like a rock, you might say, no matter the type. But until now, nobody had created a model that could accurately reproduce these behaviors.

In the paper, Rattez and Veveakis describe a computational model that takes into account the energy balance of all the complicated mechanical processes taking place during fault movement. They incorporate weakening mechanisms caused by heat that are common to all types of rock, such as mineral decomposition, nanoparticle lubrication and melting as the rock undergoes a phase change.

After running all of their simulations, the researchers found that their new model accurately predicts the drop in friction associated with the entire range of fault speeds from experiments on all available rock types including halite, silicate and quartz.

(Article continued on page 64)

Leveraging LNAPL Transmissivity at your Petroleum Site

By: Brandon Tufano

Introduction

As consultants, it is our job to progress site remediation towards closure in the most effective and efficient way possible. This is a challenge when considering the size of some of our petroleum impacted sites. The impracticality of removing every molecule of petroleum is rarely time or cost effective. By applying the mechanics of aquifer transmissivity to saturated thickness of light non-aqueous-phase liquid (LNAPL), we can provide an alternative method by which to gauge a site's progression towards closure. Transmissivity of an aquifer is defined as the rate of flow under a unit hydraulic gradient through the saturated cross-sectional area of aquifer, expressed as length^2/time. By incorporating matrix material properties such as rock and soil type, porosity, and permeability, as well as LNAPL properties such as composition, saturation, and thickness of mobile LNAPL, LNAPL transmissivity can be estimated. LNAPL transmissivity is an indicator of a formation's ability to transmit LNAPL to wells and is directly proportional to LNAPL recoverability (ITRC, 2009). This proportional relationship between LNAPL transmissivity and recoverability is a much more powerful tool for evaluating LNAPL mobility and recoverability than the measure of free-product thickness in monitoring wells.

(LNAPL Tn continued on page 55)

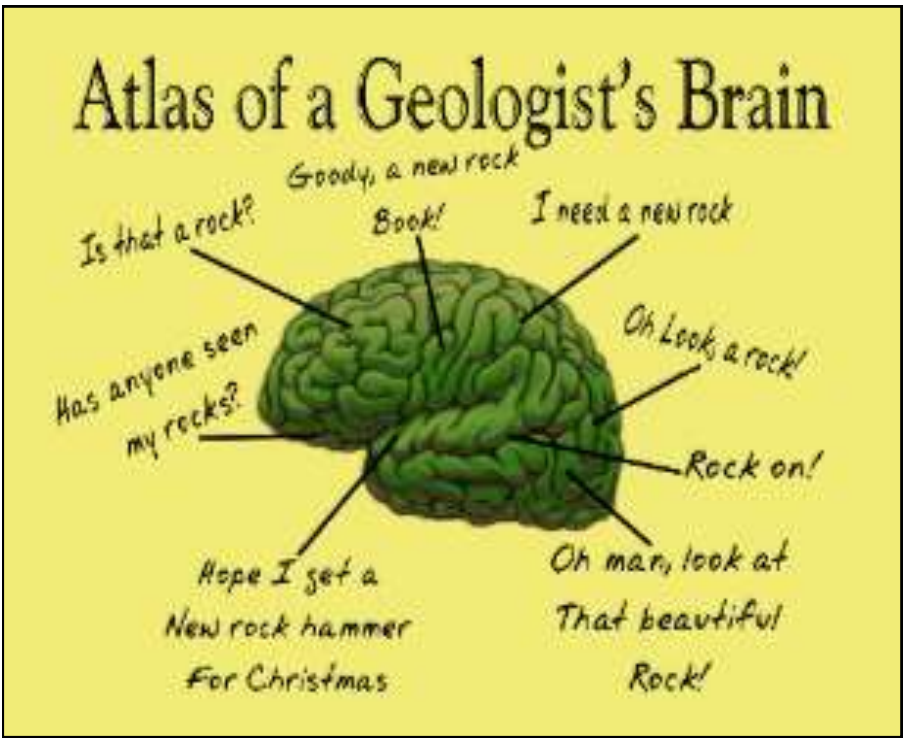
(LNAPL Tn continued from page 54)

Petroleum regulations vary greatly from state to state and typically regulatory programs allow the regulators to determine remedial endpoints. Many environmental regulations require that "free-product" (i.e., measurable petroleum product in recovery/ monitoring wells) be recovered to the maximum extent "practicable" (MEP), but fail to establish ways of quantifying the MEP. This ambiguity lends itself to prolonged remediation projects, with protracted operation and maintenance programs since the recovery end point is not clearly defined within the remedial approach, if it is even possible at all. Historically, the most popular metric to guide remediation of a LNAPL site was free-product thickness present in wells. Albeit intuitive, this metric has been proven to be poorly correlated with the volume and recoverability of the free-product in the subsurface (ITRC, 2009). A much more reliable metric to evaluate the remaining LNAPL recoverability of free-product – and thus, the risk to potential receptors – is LNAPL transmissivity. As more projects opt into advocating for the use of LNAPL transmissivity as a remediation performance metric at their sites, regulators are giving more credence to transmissivity as a measure to establish achievable endpoints for site remediation.

Industry Acceptance

In recent years, this paradigm of cleaning up to the maximum extent practicable has started to shift as states begin to realize the benefits associated with evaluating the technical factors that control LNAPL mobility and recovery (Figure 1—page 76).

(LNAPL Tn continued on page 60)



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(LNAPL Tn continued from page 55)

These new lines of thinking incorporate risk-based approaches, based on the evaluation of LNAPL recoverability through LNAPL transmissivity testing, to the assessment of LNAPL-impacted sites (ITRC, 2009). For instance, Michigan's Department of Environmental Quality implemented regulations determining a minimum LNAPL transmissivity of one-half square foot per day be required before LNAPL is considered no longer practicably recoverable (Michigan Department of Environmental Quality, 2014). Delaware has implemented regulations which determine the practicability of LNAPL management based on "mobile", "free," or "residual" determinations (Fischer, 2008). Texas has developed a five-step, risk-based management program for managing nonaqueous-phase liquids (NAPL) (TCEQ, 2008). Furthermore, according to the Interstate Technology and Regulatory Council (ITRC), sites in state regulatory programs in California, Kentucky, and Florida have been closed or granted "No Further Action" by demonstrating a lack of LNAPL recoverability using LNAPL transmissivity as a metric, regardless of observed in-well LNAPL thickness.

In order to apply a risk-based approach, it is necessary for consultants and regulators to have definitive metrics with which to measure the feasibility of LNAPL recoverability at a petroleum site. Theoretically, LNAPL present at or below residual saturation would have LNAPL transmissivity of zero.

(LNAPL Tn continued on page 61)

(LNAPL Tn continued from page 60)

However, as a matter of practicality and technical feasibility, the ITRC suggests that, under ideal circumstances, hydraulic recovery systems can potentially reduce LNAPL transmissivity to between 0.1 and 0.8 ft^2/day, and within this window the ambiguous "maximum extent practicable" goal is considered met. Consequently, some states have begun to edit existing regulatory frameworks to define realistic and achievable "maximum extent practicable" goals for LNAPL regulations incorporating risk-based proactive measures. Examples of these extent practicable objectives include recovery until a specific LNAPL saturation is reached or it becomes ineffective to continue removing LNAPL, or until the plume migration and movement has become static (ITRC, 2009).

Methods for Measuring LNAPL Transmissivity

The governing body providing industry guidance for evaluating transmissivity is the American Standard for Testing Materials (ASTM). The industry commonly measures LNAPL transmissivity in several different ways, as outlined in the ASTM E2856-13 – *Standard Guide for Estimation of LNAPL Transmissivity* and summarized below:

Recovery Well Evaluation – includes the evaluation of recovery well operational data (e.g., volume of product recovered and volume of groundwater pumped) by applying the theory of radial flow through a porous media (ASTM, 2012; ITRC, 2009), to determine LNAPL transmissivity. Due to the continuous

(LNAPL Tn continued on page 64)

Field and Environmental Services

(Article continued from page 53)

Because the model works well for so many different types of rock, it appears to be a general model that can be applied to most situations, which can reveal new information about the origins of earthquakes. While researchers can't fully recreate the conditions of a fault, models such as this can help them extrapolate to higher pressures and temperatures to get a better understanding of what is happening as a fault builds toward an earthquake.

"The model can give physical meaning to observations that we usually cannot understand," Rattez said. "It provides a lot of information about the physical mechanisms involved, like the energy required for different phase transitions."

"We still cannot predict earthquakes, but such studies are necessary steps we need to take in order to get there," said Veveakis. "And in theory, if we could interfere with a fault, we could track its composition and intervene before it becomes unstable. That's what we do with landslides. But, of course, fault lines are 20 miles underground, and we currently don't have the drilling capacity to go there."

Materials provided by Duke University. Original written by Ken Kingery. Note: Content may be edited for style and length .
Duke University. "'Melting rock' models predict mechanical origins of earthquakes: Friction drops as rocks slide past one another with greater speed." ScienceDaily. ScienceDaily, 17 January 2020. <www.sciencedaily.com/releases/2020/01/200117080829.htm>.

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(LNAPL Tn continued from page 61)

collection of data that is often required as part of recovery system operation and maintenance, there is a robust data set generated that can be utilized to support the LNAPL transmissivity calculation. Furthermore, a well-defined conceptual site model is necessary to evaluate the parameters used in the equation. Transmissivity estimates derived from recovery well operational data represents the area of influence by pumping drawdown.

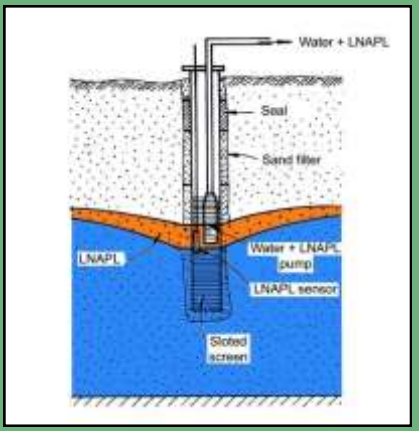

Diagram of a duel-phase extraction well

Baildown Testing – involves "instantaneously" displacing (i.e., bailing) a calculated volume of LNAPL from a monitoring well inducing a hydraulic head differential. Following LNAPL removal, the well is incrementally gauged to determine the amount of time it takes for the initial thickness of LNAPL to recover. LNAPL transmissivity can be calculated using LNAPL recovery data and the methods by Bouwer and Rice, Cooper and Jacob, or Cooper, Bredehoeft, and Papadopulos (Cooper and Jacob, 1946; Cooper, et. al 1967; Bouwer and Rice, 1976). Each of these methods, or a

(LNAPL Tn continued on page 70)

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(LNAPL Tn continued from page 67)

combination of all three, can be applied using a program such as the Microsoft Excel based API LNAPL Transmissivity Workbook Tool (API, 2012). The baildown test is a versatile method for estimating LNAPL transmissivity given that it can be performed at any monitoring well with greater than approximately 0.5 feet of product thickness (ITRC, 2009). It is important to note that the transmissivity gathered from the baildown test represents a limited area surrounding the well and should not be applied to the surrounding aquifer without a strong conceptual site model that suggests homogeneity across the formation.

Skimming Method – involves the skimming of LNAPL from the groundwater surface in a well using a pump. Immediately following the removal of LNAPL the well is gauged until 25 percent of its original pre-skimming thickness returns. The well is then reskimmed and gauged in this manner until the recharge and removal come into equilibrium. This data is entered real-time into a spreadsheet that calculates transmissivity (provided by a third party or developed by the consultant) and the test is complete when two consecutive transmissivity values are within 25 percent of each other. This indicates that LNAPL removal has come into equilibrium with well recovery rate and transmissivity of the well is stable and representative of subsurface conditions. Like the baildown test the manual skimming test can be used on any well with LNAPL including wells with less than one-half foot of

(LNAPL Tn continued on page 71)

(LNAPL Tn continued from page 70)

apparent LNAPL thickness. The limiting factor for manual skimming is the viscosity of the LNAPL and its depth.

The transmissivity of deeply located or highly viscous LNAPL may prove troublesome through this method.

Dye Tracer Testing - includes placing a known concentration of fluorescent dye tracer into a well and monitoring its rate of dispersion into the surrounding media. The dye displacement is measured with an ultraviolet-visible (UV/VIS) spectrometer attached to a down-hole fiber optic cable. The rate at which the UV dye disperses is assumed to be proportional to LNAPL flow. Following the methods of Sale et al. (2007), Smith et al. (2011) and Mahler et al. (2012), an estimation of the LNAPL flow through a monitoring well can be determined. The long test duration, complicated nature of the observation equipment, and assumptions about subsurface conditions makes this a difficult test to conduct.

	Test Duration	Representative Area	Frequency of Method Transmissivity Value	LNAPL Type	LNAPL Thickness	Capital Cost*/ Analysis Cost
Recovery Well Evaluation	Until steady state conditions are met	Area	Continual time series	No limit	No Constraint	Low/Moderate
Baildown Test	Minutes to months	Point	Singular event	No limit	> 0.5 ft	Low to Moderate/ Moderate
Manual Skimming Test	Hours to weeks	Point	Singular event	High viscosity may be problematic	No Constraint	Low/Medium
Dye Tracer Test	3 - 6+ months	Point	Time-averaged over event duration	High viscosity may be problematic	< 0.2 ft	High/Low

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(LNAPL Tn continued from page 71)

Table 1: Advantages, limitations, and costs of various LNAPL transmissivity tests.

Conclusion

Over the last several years, several states have begun to realize the impracticality of the ambiguous "maximum extent practicable" determination when remediating LNAPL-impacted sites. Instead, risk-based approaches backed by quantifiable goals better aid in the interpretation, evaluation, and remediation of these complex sites. LNAPL transmissivity metrics set forth by the ITRC in 2009 have allowed sites to come to closure as LNAPL transmissivity falls below 0.8 ft^2/day, under the premise that the LNAPL at this transmissivity is practically immobile. As regulations surrounding LNAPL transmissivity evolve, it is important to continually evaluate site conditions and develop reliable methods for estimating LNAPL transmissivity. As consultants, we act as the bridge between regulatory bodies and our clients by understanding new regulations, their implementation,

(LNAPL Tn continued on page 76)

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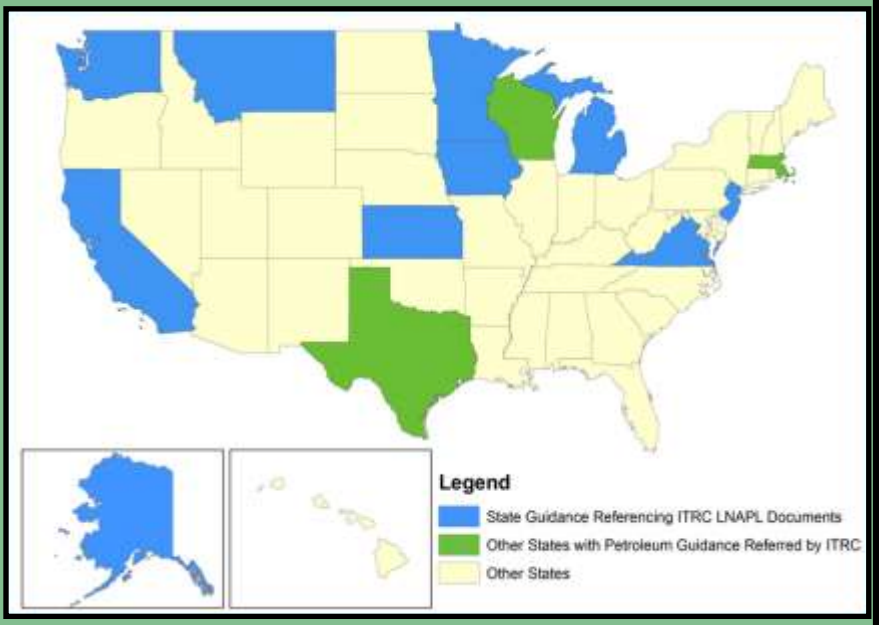

Figure 1: Regulatory map depicting states incorporating or referencing ITRC LNAPL documentation into guidance documents from ITRC 2009.

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A look into the center of the Earth

The Earth's inner core is hot, under immense pressure and snow-capped, according to new research that could help scientists better understand forces that affect the entire planet.

llustration of Earth's core (stock image; elements furnished by NASA).

Credit: © Vadimsadovski / Adobe Stock

The snow is made of tiny particles of iron -- much heavier than any snowflake on Earth's surface -- that fall from the molten outer core and pile on top of the inner core, creating piles up to 200 miles thick that cover the inner core.

The image may sound like an alien winter wonderland. But the scientists who led the research said it is akin to how rocks form inside volcanoes.

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"The Earth's metallic core works like a magma chamber that we know better of in the crust," said Jung-Fu Lin, a professor in the Jackson School of Geosciences at The University of Texas at Austin and a co-author of the study.

The study is available online and will be published in the print edition of the journal JGR Solid Earth on December 23.
Youjun Zhang, an associate professor at Sichuan University in China, led the study. The other co-authors include Jackson School graduate student Peter Nelson and Nick Dygert, an assistant professor at the University of Tennessee, who conducted the research during a postdoctoral fellowship at the Jackson School.

The Earth's core can't be sampled, so scientists study it by recording and analyzing signals from seismic waves (a type of energy wave) as they pass through the Earth.
However, aberrations between recent seismic wave data and the values that would be expected based on the current model of the Earth's core have raised questions. The waves move more slowly than expected as they passed through the base of the outer core, and they move faster than expected when moving through the eastern hemisphere of the top inner core.

The study proposes the iron snow-capped core as an explanation for these aberrations. The scientist S.I. Braginkskii proposed in the early 1960s that a slurry layer exists between the inner and outer core, but prevailing knowledge about heat and pressure conditions in the core environment quashed that theory. However, new data from experiments on core-like materials conducted by Zhang and pulled from more recent scientific literature found that crystallization was possible and that about 15% of the lowermost outer core could be made of iron-based crystals that eventually fall down the liquid outer core and settle on top of the solid inner core.

"It's sort of a bizarre thing to think about," Dygert said. "You have crystals within the outer core snowing down onto the inner core over a distance of several hundred kilometers."
The researchers point to the accumulated snow pack as the

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(A Snowy Core continued from page 80)

cause of the seismic aberrations. The slurry-like composition slows the seismic waves. The variation in snow pile size -- thinner in the eastern hemisphere and thicker in the western -- explains the change in speed.

"The inner-core boundary is not a simple and smooth surface, which may affect the thermal conduction and the convections of the core," Zhang said.

The paper compares the snowing of iron particles with a process that happens inside magma chambers closer to the Earth's surface, which involves minerals crystalizing out of the melt and glomming together. In magma chambers, the compaction of the minerals creates what's known as "cumulate rock." In the Earth's core, the compaction of the iron contributes to the growth of the inner core and shrinking of the outer core.

And given the core's influence over phenomena that affects the entire planet, from generating its magnetic field to radiating the heat that drives the movement of tectonic plates, understanding more about its composition and behavior could help in understanding how these larger processes work.

Bruce Buffet, a geosciences professor at the University of California, Berkley who studies planet interiors and who was not involved in the study, said that the research confronts longstanding questions about the Earth's interior and could even help reveal more about how the Earth's core came to be.

"Relating the model predictions to the anomalous observations allows us to draw inferences about the possible compositions of the liquid core and maybe connect this information to the conditions that prevailed at the time the planet was formed," he said. "The starting condition is an important factor in Earth becoming the planet we know."

The research was funded by the National Natural Science Foundation of China, Fundamental Research Funds for the Central Universities, the Jackson School of Geosciences, the National Science Foundation and the Sloan Foundation.

(End)

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The Flatirons

By Brandon Tufano

For me, exposed tilted planer bedding has always held an inexplicable allure. By far not the most exciting geologic feature but none-the-less one that will draw me right in to marvel at the near perfect slanted sheets. Amongst the most famous of these are The Flatirons near Boulder, Colorado. The Flat Irons are a rock formation consisting of… you guessed it, flatirons. There are five prominent Flatirons ranging from north to south numbering First through Fifth, respectively along the east slope of Green Mountain (elevation of approximately 8,000 ft), and the term "The Flatirons" sometimes refers to these five alone. However, in addition to the five dominant flatirons numerous additional named flatirons protrude along the southern part of Green Mountain, Bear Peak, and among the surrounding foothills.

The Flatirons consist of conglomeratic sandstone of the Fountain Formation and their age is estimated at 290 to 296 million years old. It is estimated that The Flatirons were lifted and tilted into their present orientation between 35 and 80 million years ago, during the Laramide Orogeny. The Flatirons were subsequently exposed by erosion. What we are left with today is a simple yet marvelous expression of the very basics of geology. Next time you're in the area, do yourself a favor and talk a walk, you won't regret it.

NE/AIPG 2020 PUBLICATION SCHEDULE

Winter Newsletter

January 10	Deadline (Material to Editor)
January 24	Content to Publisher
February 10	E-mail to Members

Directory of Members

February 10	Deadline (Material to Editor)
March 13	Content to Publisher
April 13	E-mail to Members

Spring Newsletter

March 20	Deadline (Material to Editor)
April 3	Content to Publisher
April 20	E-mail to Members

Indian Summer Newsletter

July 24	Deadline (Material to Editor)
August 14	Content to Publisher
September 1	E-mail to Members

Holiday Newsletter

October 9	Deadline (Material to Editor)
October 23	Content to Publisher
November 9	E-mail to Members

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ANGELO TAGLIACOZZO MEMORIAL GEOLOGICAL SCHOLARSHIP TRUST FUND

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Solve it!
Simply see Pg. 89 and then

Move into Action!

(End)

Celebrating 34 Years of Scholarships!
The Angelo Tagliacozzo Memorial Geological Scholarship

The Angelo Tagliacozzo Memorial Geological Scholarship was established by the Northeast Section of the American Institute of Professional Geologists in late 1986. The first Scholarships were presented to undergraduate Geology students in 1987.

ATMGS recognizes the dedicated leadership and service which Angelo provided to NE/AIPG, to AIPG, and to the geological profession, until his untimely passing on October 11, 1986. The Scholarship furthers Angelo's goal of acquainting young geologists with AIPG and with AIPG's importance to the geological profession.

ANGELO TAGLIACOZZO (1936 - 1986)

Angelo Tagliacozzo received his doctorate in Geology from the University of Rome (Italy) in 1962. Thereafter, he worked in various positions as geologist, geophysicist, and hydrogeologist, which included assignments abroad, in the U.S., and with the United Nations. Angelo provided exemplary service to AIPG at the Section and National levels. He was a Northeast Section Executive Committee Member (1973-1982), Vice President (1977-1978), President (1979-1980), National Advisory Board Delegate (1981-1982), and Screening Board Chairman (1984-1986). Angelo's dedication to and leadership of the Northeast Section Screening Board has become the ultimate standard against which service in such a position is measured. Angelo also served as an AIPG National Executive Committeeman (1982); he was a vigorous advocate of measures to increase professionalism. Angelo was (and will be remembered as) a respected professional...and a friend.

THE SCHOLARSHIP

NE/AIPG grants Scholarships to undergraduate geology students annually. The Scholarships are designed to help with the cost of summer field courses, textbooks, and other aspects of geological education. Scholarships are awarded, both on academic achievement and on financial need, to students enrolled in recognized geology programs at colleges or universities in New England, New Jersey, & New York.

YOUR CONTRIBUTIONS

Your participation is encouraged in support of this dynamic memorial to Angelo and his recognition of the importance of AIPG to the geological profession. Contributions to the Scholarship Perpetual Trust Fund should be written to:
Angelo Tagliacozzo Memorial Geological Scholarship Trust Fund, and mailed to:

NE/AIPG Geological Scholarship Trust Fund
c/o Dennis McGrath, CPG
P.O. Box 472
Hastings-on-Hudson, NY 10706-0472

All Contributions are invested perpetually, with earnings thereon used solely for the Scholarship. NE/AIPG bears all costs of administration. Please ask your employer about Matching your contribution, and Additional corporate contributions.

For further information, contact Dennis McGrath:
mcgrathdg@gmail.com Cell: 914-424-8816

Memorandum

To: Dennis McGrath, Chairman, ATMG Scholarship, Northeast Section, AIPG
From:
Date:
Re: *I'm Taking the Pledge:* ***I'M IN FOR 2020!***

Dear Dennis,

Just a quick note to let you know that I'm 100% with you when it comes to achieving the Section's goal of 100% participation in support of the Scholarship Perpetual Trust Fund during 2020, the 34th Anniversary of the Scholarship! I agree with your encouragement that each and every Section Member make a contribution in accordance with their ability... and this is the one time when I don't want to be the odd person out!

I'M IN FOR 2020!

For 2020, the 34th Anniversary, I'm considering pledging... Thirty Bucks A Week, Thirty Bucks A Month, or Thirty Bucks for the Year!

Now, I know it could be more—and you know it could be less!—but I am committed to contributing as much as I can, so I'm not going to delay it any longer: **I'M IN FOR 2020!**

Yes, my personal budget is tight, but I figure that, somehow, I can set aside $30 each month (aka the cost of weekly lattes) this year to give back to the profession that has given me so much. Also, I just wanted to tell you I am delighted to know that every one of those hard-earned dollars that I contribute will be INVESTED in the Scholarship Perpetual Trust Fund, so my contribution today can keep on giving, year after year!

And that makes me feel like my contribution really means something, both now and in the long term! I have thought it over, and I know how important 100% participation is for Section pride! So, Dennis, ***I'M IN FOR 2020***

Professionally yours,

_____

Times are really (GREAT / poor), so I am pledging:
_____30 Bucks A Week ($1560 for 2020)
_____30 Bucks A Month ($360 for 2020)
_____30 Bucks A Year ($30 for 2020)

Other: _____ (Every little bit is better than nothing!)

___ I'll make it easy on you; I have enclosed my check, made out to *"Angelo Tagliacozzo Memorial Geological Scholarship Trust Fund."*
___ Please invoice me for my 2020 pledge by 10/31/20. I'll pay by 12/1/20.

Signed: _____

Name Printed: _____

Address: _____

Mail this Pledge to: NE/AIPG Geological Scholarship Trust Fund, c/o Bob Blauvelt, 345 Stuyvesant Ave Lyndhurst, NJ 07071

- or -

Email this Pledge to: NE/AIPG Geological Scholarship Trust Fund, c/o Bob Blauvelt blauvelt@geiconsultants.com