Granite State Geologist

The Newsletter of the Geological Society of New Hampshire,
Spring Edition – March 2018 – Issue No. 100
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In this issue:

MESSAGE FROM THE PRESIDENT

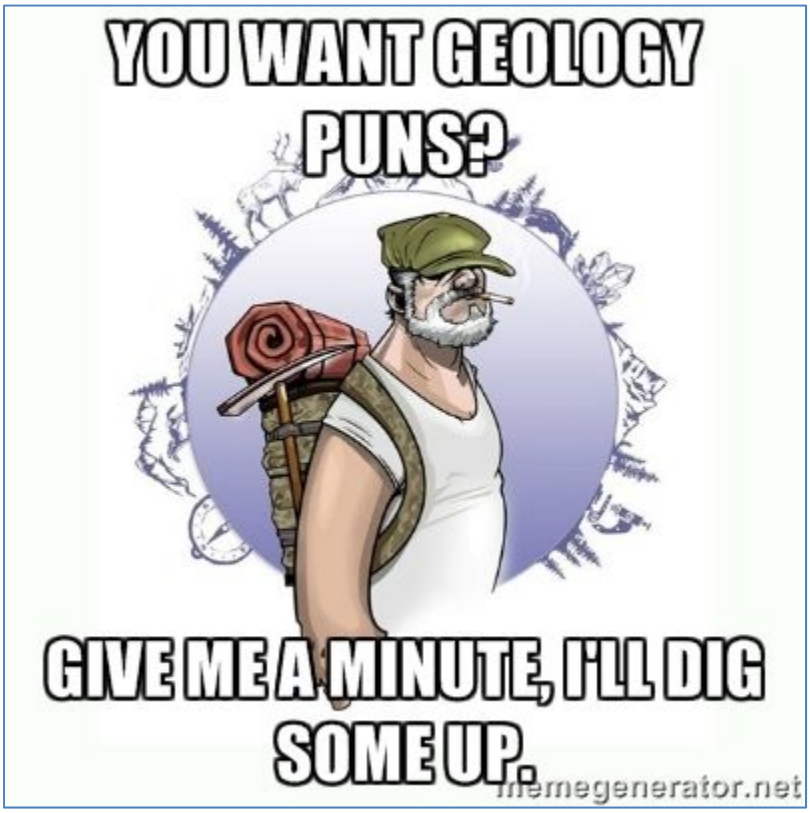
This is the 100th issue of the Granite State Geologist. As editor of the newsletter and Society president, I am proud of the advances that the Society is making and I hope the Society and the newsletter are entertaining and informative for you.

Our next dinner meeting speaker is, Ken Galli, who will be presenting some new dates of Late Jurassic volcanoes in Western Colorado and the implications for dinosaurs. We will be meeting at the Puritan in Manchester on April 12 and it's not too early to make your reservation.

Just a note, the prices for even a buffet meal are on the rise. The society is working hard to provide a great dinner at a reasonable price. Sharon Lewandowski, your member-at-large, has been working with the restaurants and making the arrangements and deserves a sincere "Thank you" from all of us. But it's not just Sharon, each of the board members puts time and thought into maintaining and improving the Society. But some of us will be term-limited out of our current positions and elections are just a few months away. If you think you might have something to contribute, the nomination committee, Thor Smith and Abbie Fopiano, would like to hear from you. Or speak to any board member about attending a Board meeting if you'd like to try before you buy. Think about it.

The Board is well along in planning a summer field trip in the Boston area. Details at the next meeting and in the next edition of the newsletter, but for right now I will leave this mantra of formations to tantalize you: Boston Bay Group: Brookline Member, Roxbury Fm. and its Dorchester and Squantum members, as well as the Cambridge Formation's argillite.

So even though this edition is filled with stories about ice and snow, mega-storms and glaciers, spring is on its way. Maple sap is boiling in shacks around the state and the snow is melting off the outcrops. Do you remember where you left your Brunton?



WHAT IS YOUR BOARD DOING? Submitted by Shane Csiki, Secretary

On Thursday, March 15, Doug Allen hosted a meeting of the Geological Society of New Hampshire Board of Directors at the offices of Haley and Aldrich in Bedford. The Board discussed several items of interest.

GSNH has not recently had any applicants for the education funds that the Society makes available for schools. Lee Wilder and Tina Cotton, members of the Education Committee, are working to promote the availability of these funds to public school teachers throughout the state.

Plans for the summer field trip are underway. This year, plans are in the works to travel to the Boston Bay Area and examine some of the geologic features present there. The exact date of the field trip is yet to be determined. However, it will be planned for a Saturday and timed so that the trip arrives at the sites of interest during low tide, to allow some of the conglomerates to be seen. The visit serves as a way to follow up on some of the topics covered by Joshua Keeley, in his talk at the January dinner meeting. The Board is investigating the provision of bus transportation to the Boston area for the tour. So, stay tuned!

The next dinner meeting will be held at the Puritan Backroom Restaurant in Manchester on Thursday, April 12, 2018. The speaker will be Dr. Kenneth Galli from Boston College, who will be our summer trip leader. The October dinner meeting, which also will serve as the annual GSNH meeting, will likely be held back in the Concord area at the Makris Restaurant.

Our next Board of Directors meeting will be held on Thursday, June 14, 2017, at 6 PM in Hopkinton. All members are welcome to attend our meetings. Please let a Board member know if you would like to attend or if there is an item of interest that you would like added to the agenda.

A GSNH TEE SHIRT WOULD SURE LOOK GOOD ON YOU!

Ask Tom Fargo or Julie Spencer about buying one at the next dinner meeting!

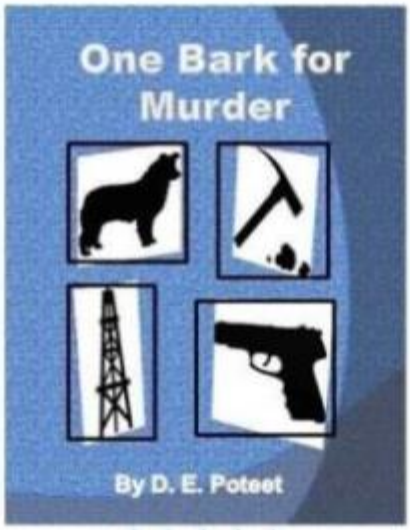
Still only $18.

ASSOCIATION FOR WOMEN GEOSCIENTISTS

The Association for Women Geoscientists is an international organization devoted to enhancing the quality and level of participation of women in geosciences and to introduce girls and young women to geoscience careers. Membership is open to anyone who supports AWG's goals.

AWG was founded in 1977 in the San Francisco Bay Area, with approximately 50 members. These early members often met in each other's homes to discuss their research activities and career situations. Women from other parts of the country learned about AWG through its published newsletter. The first official chapter formed in 1980 when about 40 women in Denver became associated with the Bay Area group. Today, the AWG has over 1,000 members who are either affiliated with one of its regional or prospective chapters or are members-at-large. There are AWG members in 48 states as well as several foreign countries.

http://www.awg.org/



★★★★★

Five Star Rating from Kindle Readers

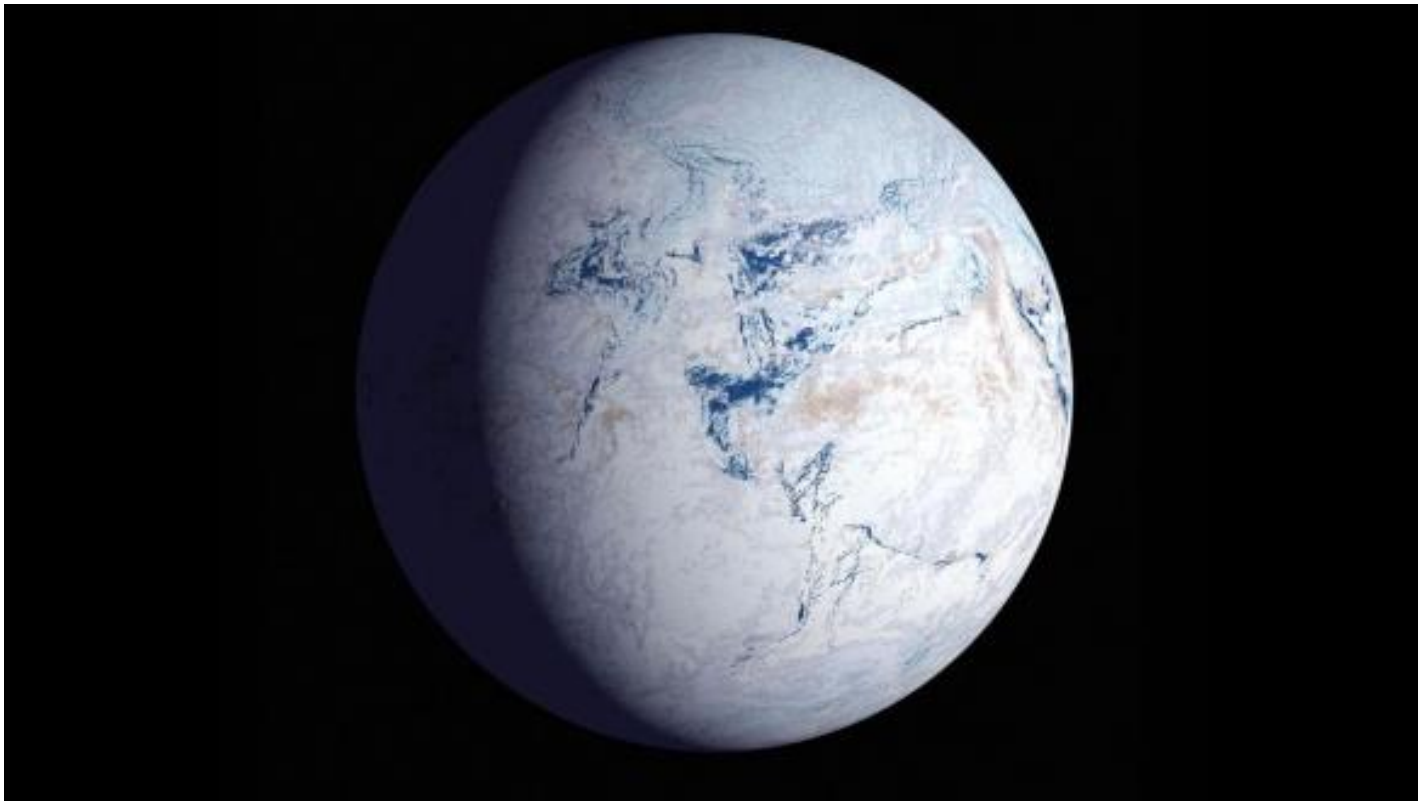
Go to twinauthors.com or Kindle and download your copy now!

New Geology Themed Mystery Series

The book's lead character is a geologist and there is a lot of information about geology and gas exploration in the Fort Worth area included in the narrative. There will be several books in the series, all presented in different geologic and hydrogeologic settings. The second book, almost done, is set in the hill country near San Antonio and deals with aquifers and caves.

FOLLOW-UP NOTES ON SNOWBALL EARTH by Joshua Keeley, Hydrogeologist, New Hampshire Geological Survey, New Hampshire Dept. of Environmental Services, 603-271-2875, Joshua.keeley@des.nh.gov

Thanks again for the opportunity to speak in January. I was thrilled to see such an interest in the topic so I put together some additional resources for those who want to explore further.



Artist's rendering of an ice planet - Chris Butler/Photo Researchers Inc.

Snowballearth.org is a comprehensive resource but could use an update and more figure captions. Last updated in 2006, it serves as a time capsule that summarizes the fundamentals of the hypothesis around the time when the first U-Pb zircon dates were coming in. Compare this information to Paul Hoffman's most recent paper (a must read: Hoffman et al., 2017, Snowball Earth climate dynamics and Cryogenian geology-geobiology, Science Advances, is posted on ResearchGate.net), and I think you'll find that the general hypothesis is refined yet unchanged in the wake of much new research. The site has links to many critical papers, numerous teaching slides, and some brief explanations of the tools used and the mechanisms behind the hypothesis. For a more thorough and dramatic summary of the science and people behind it, read Gabrielle Walker's book, Snowball Earth. For a bite-sized sample the whole family can enjoy, check out the BBC documentary posted on YouTube here: https://www.youtube.com/watch?v=Cm_aDTcxAas. For the ultimate fanatics who want to hear it from Paul Hoffman, the Earth Dynamics Research Group has posted his 5.5-hour 2016 lecture on YouTube (https://www.youtube.com/watch?v=RxFmcgjXtgI). Here, you will not only hear about the deductive geological science that I briefly covered, but you'll also hear about the inductive, forward science of climate modeling applied to the snowball climatic state using modern global circulation models. Lastly, I recommend perusing photos of Cryogenian and Ediacaren glaciogenic rocks and "cap carbonates" from all over the globe on the University of Guelph's Photo Atlas of Neoproterozoic Glaciations here: https://atrium.lib.uoguelph.ca/xmlui/handle/10214/9365

Hopefully, there are some indefatigable skeptics out there who are interested in finding some flaws with any of this. If you do, please keep me posted, and feel free to contact me for material, comments, discussion, or questions. Happy hammering, Joshua Keeley

LEGISLATIVE UPDATE – March 2018 – by Tom Fargo

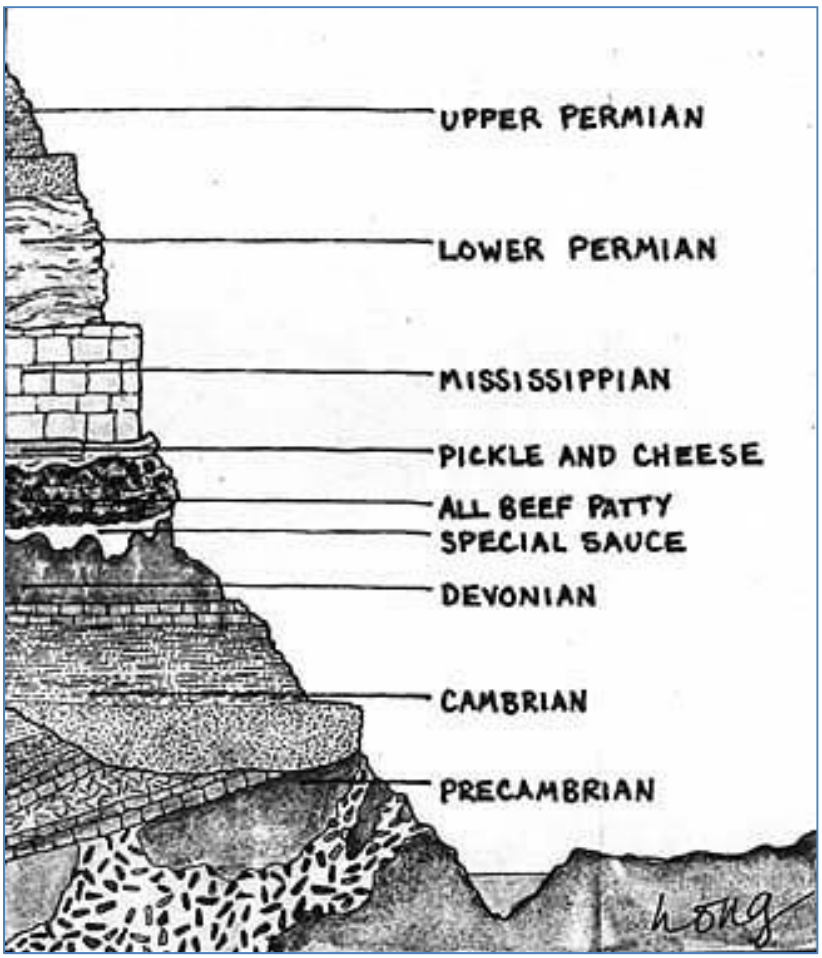
At this writing, the 2018 session of NH General Court (State Legislature) is approaching March 22, 2018 "cross-over", the date when bills that have been approved by House and Senate are required to be submitted for review in the opposite chamber.

The Legislative Committee has been tracking 25 bills of interest. Ten of these bills have been voted by the full House or Senate as "Inexpedient to Legislate" (ITL), which is a somewhat polite way to saying the bill was killed. Four of the bills voted ITL proposed to establish more stringent drinking water quality standards or monitoring requirements. Three other bills of interest that were voted ITL dealt with potential penalties and compensation for causing environmental damages. House Bill (HB) 1226 that would not allow municipalities to restrict the use of water drawn from private wells was voted ITL. Therefore, existing law RSA 41:11-d still allows the local governing body to establish regulations restricting use of water from private wells.

Three active bills being tracked by GSNH are related to professional licensure and regulation in NH. HB-1685 – "*AN ACT establishing a statutory commission for oversight over occupational regulation"* was passed by the full House contrary to the Executive Departments and Administration committee's recommendation to ITL. HB-1685 has the strong support of Governor Sununu and I anticipate that the Republican-majority Senate will pass it to become law. It is unclear what impact this will have on licensure of NH Professional Geologists.

HB-1685 proposes to create an nine-member commission "responsible for reviewing legislation to enact or modify an occupational regulation to ensure compliance with the *policy of the state that the right of an individual to pursue an occupation is a fundamental right and that where the state finds it is necessary to displace competition, it will use the least restrictive regulation to protect consumers from present, significant, and substantiated harms that threaten public health and safety.*"

The GSNH Legislative Committee will continue to follow General Court action on the remaining 15 bills of interest through the 2018 legislative session.



THE ROMANCE OF GEOLOGY IN RUSSIA: A TRIBUTE TO ALEXANDER AINEMER

by Paul Belasky http://www.geotimes.org/nov03/column.html

Belasky is an associate professor of geology and paleontology at Ohlone College in Fremont, Calif.

Before Alexander Ainemer became a marine geologist, he led the author , Paul Belasky, into the romance of geology with tales of field work in Central Asia.

It happened more than 30 years ago in a far-off place — a one-room communal apartment in the heart of St. Petersburg, Russia (then Leningrad, Soviet Union). We kids huddled around the dining table and were staring at strange objects — crystals of all colors and shapes, fossils, a large peculiar compass, a skin of a huge desert lizard, and an ancient book written on parchment in Arabic. A new world, mysterious yet knowable through science, was opening up before us, and a tall, striking man (my best friend's father) was leading us into it. He had just come back from a desert in Central Asia and, in a hushed tone, was telling us how he found the book between the moving barchans in Turkmenistan. He gave exotic-sounding names to crystals, made us use the strange compass to find each other hiding in a poorly lit room, and talked with great wonderment about desert dunes, scorpions and black spiders, ruined fortresses, and heavy backpacks. I remember it as if it were yesterday; in that room, listening to Alexander Ainemer, I decided to become a geologist. And I am still thankful to him for that.

Geology in the Soviet Union in the 1960s and 1970s was a romantic profession. Large sections of the country were still waiting to be explored and mapped. Foreign travel was still impossible for most Soviets, so idealistic youths were drawn to geology for the thrill of adventure and exploration. Some of them really thought they could find personal freedom, if not by going west, then in the distant corners of the wild east — Siberia, the "sleeping land." The Soviet government encouraged that trend with large centrally planned initiatives and expeditions. This was the heady time of hope after the end of Stalin's purges, and it was geologists who were returning to the remote areas formerly ruled by the vast archipelago of prison camps.

Minimally supplied geological parties trekked for months on end across the huge country. They mapped, carried loads of samples, fished and hunted, wrote poetry, drank vodka, and sang songs around the campfire. In fact, many Russian musicians and poets (Nobel laureate Joseph Brodsky included) started out as geologists or worked as technicians in those parties. Few outside of Russia know that it was geologists who started an important movement in modern poetry in St. Petersburg in the 1960s, called the "Geological School." Furthermore, geologist authors dominated a genre of unofficial, often politically risqué songs ("bard songs"). The songs were about cloud shadows in the tundra, windy mountain passes, shamans and dervishes in time-forgotten villages, apatite, camaraderie, lack of cigarettes, and nostalgia for home and love during long field seasons.

It was tough, back-breaking work for a meager starting pay of about 80 rubles a month. What Russian geologist hasn't experienced floorless, leaky tents in a rainstorm, or being stranded in the taiga and running out of food, or even having to stop a train in the middle of nowhere after walking for miles to evacuate a sick comrade? Internationally renowned modern composer Giya Kancheli describes his early experience as a young geologist in Russia: "…after walking more than 30 km with a backpack across taiga in a single day, I collapsed in my tent and wrote a list of professions that did not involve any walking. Music composition was one of them, and I chose it.**" Even until the late 1980s, saying you were a geologist to girls in St. Petersburg was a great pick-up line — often greeted with admiring smiles and questions about exotic places and wild excesses in the field. Yet when I told my father that I was going to become a geologist he said: "Do you want to be one of those inebriated loudmouths with backpacks and guitars who bellow songs on night trains?"**

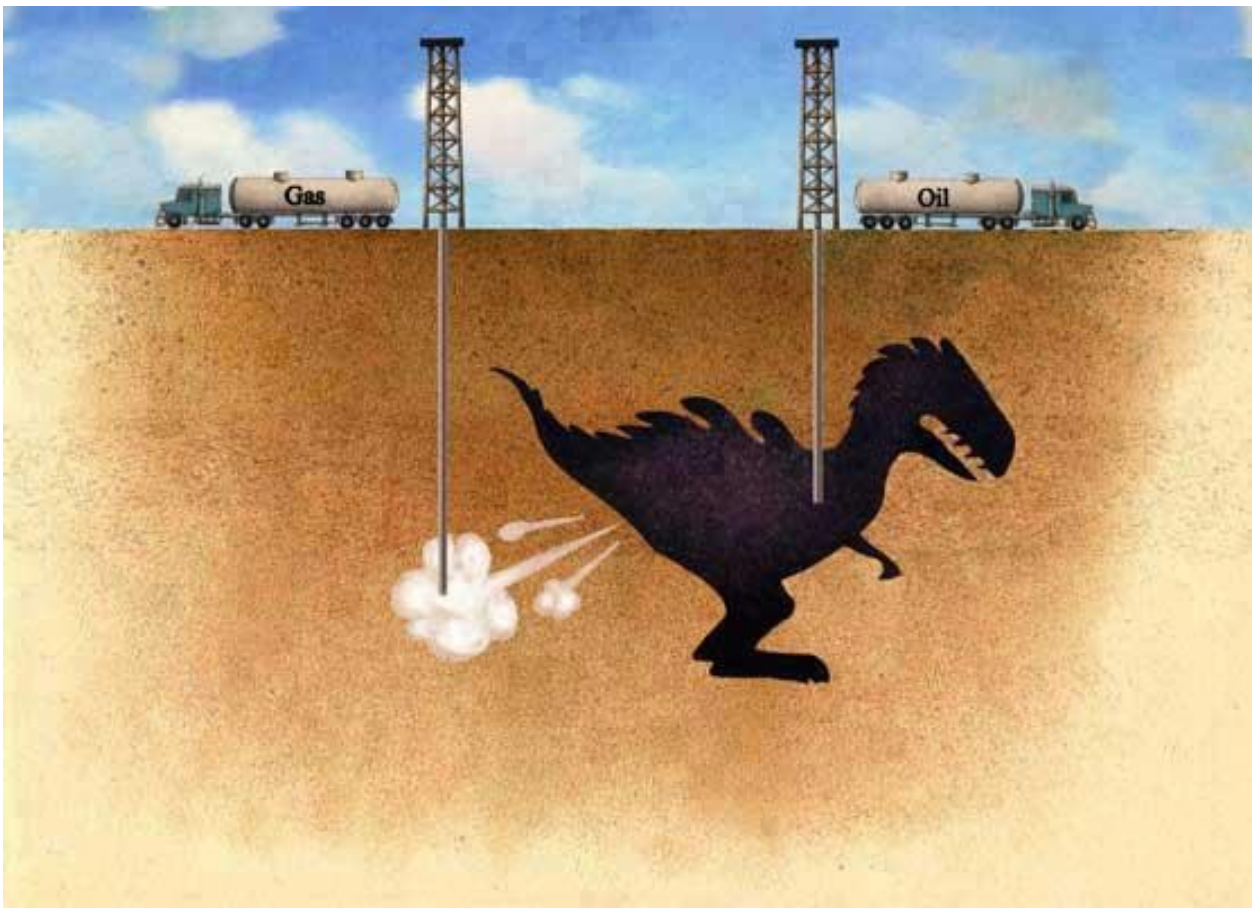
Ainemer fit the romantic image of an explorer very well. He was darkly handsome and looked like an Assyrian prince. Kind and humble, his eyes would light up like those of a child when he talked about his life's passion, geology. His works are not widely known in the United States because only a fraction of his more than 200 articles, monographs and books were published in English. But numerous colleagues in Russia, many now scattered across the globe, knew him as a brilliant, dedicated and

prolific scientist who wasn't afraid to enter new fields. In many ways, his career mirrors that of an entire generation of geologists and tracks the story of Russian (Soviet) geology as a whole.

Ainemer was born in the city of Kharkov (now in Ukraine) in a Jewish family and moved to St. Petersburg as a child. After graduating from the historic Leningrad Mining Institute in 1957, he worked for 15 years at the Geological Institute (VSEGEI). After receiving his Ph.D. in 1968, he became interested in marine geology and began working at the Okeangeologiya research institute in St. Petersburg in 1974, eventually becoming the head of research. His studies there covered gold and tin placer deposits on continental shelves of the Arctic Ocean, as well as metal-bearing sediments of the Pacific Ocean. He became a professor at his alma mater, received a doctorate degree in 1984, and branched out into the new field of geoecology — geochemical environments and sediment formation along the marine shelves of the northeastern Soviet Union. His last major work in Russia was the monumental Atlas of Bottom Sediments of the World Ocean (sadly still unpublished due to financial snags and red-tape).

In 1994, Ainemer left behind his beloved work at Okeangeologiya to join his wife and son in Israel. It was very difficult for him to resume work in a new country with far less geological real estate than Russia but no shortage of geologists, many of whom were much younger and fluent in English. But he never abandoned his passion.

In 1997, Dr. Ainemer took a job at the Center for Technological Education in Holon, Israel. Just as he began to find his place as a working geologist in a new country, a sudden illness interrupted his work and in just a few months took him away from us in July 2001. He continued working until his last days, a devoted hero to his profession. He simply could not part with geology. Like many people from Russia, Dr. Ainemer had many friends. In almost 40 years of knowing him, I have not met a single person who did not smile warmly at the mere mention of his name. His passing and that of numerous other geologists of his generation marks the twilight of the romantic age of Russian geology.



SMALL HYDROELECTRIC DAMS INCREASE GLOBALLY WITH LITTLE REGULATION

Michelle Ma UW News - January 22, 2018
https://www.washington.edu/news/2018/01/22/small-hydroelectric-dams-increase-globally-with-little-research-regulations/

Hydropower dams may conjure images of the massive Grand Coulee Dam in Washington state or the Three Gorges Dam in Hubei, China — the world's largest electricity-generating facility.

But not all dams are the stuff of documentaries. Tens of thousands of smaller hydroelectric dams exist around the world, and all indications suggest that the number could substantially increase in the future. These structures are small enough to avoid the many regulations large dams face, and are built more quickly and in much higher densities. As streams, rivers and watersheds absorb more small dams, however, surprisingly few scientific studies have considered their environmental impact, and policies or regulations are lacking or largely inconsistent.

A small hydropower dam on Rutherford Creek in British Columbia, Canada. This dam produces 49 megawatts of power. ***Rylee Murray***

University of Washington researchers have published the first major assessment of small hydropower dams around the world — including their potential for growth — and highlight the incredibly variability in how dams of varying sizes are categorized, regulated and studied. Their paper, the first to provide a global synthesis of the science and policy of small hydropower, appears this month in the journal Frontiers in Ecology and the Environment.

"As we started exploring this topic of small hydropower development, we realized we're facing a proliferation of this kind of facility, but we don't know exactly how their environmental impacts scale up in a watershed," said lead author Thiago Couto, a UW doctoral student in the School of Aquatic and Fishery Sciences.

A 22-megawatt small hydroelectric project on Stokke Creek in British Columbia, Canada. Rylee Murray

"We have identified some important gaps in policy and science that should be filled to better manage small hydropower dams and to have science that really informs policy."

Dams, big or small, have the potential to change a river's water flow, temperature, sediment, and ultimately the patterns in plant and animal diversity. These factors have been long-studied for large dams, yet have been largely ignored for small dams — especially considering the potential cumulative effects of many small dams in a single river system.

Their research reports that nearly 83,000 small hydropower plants are operating or are under construction in 150 countries. For every large hydroelectric dam, 10 small dams exist. If all hydropower capacity were to be developed, the study estimates that this number could more than triple.

Small hydropower can take many different forms. Some small dams are built to store water in reservoirs and then release water downstream, while others divert water away from rivers into powerhouses; in all cases water is used to turn turbines and create electricity.

One of the challenges the researchers faced in compiling these numbers is that countries define "small" hydropower plants differently. As such, there is no international standard with which to categorize and compare dams. Moreover, while the modifier "small" is assumed to equate with few environmental impacts, this is a largely untested notion.

Additionally, countries that do classify small hydropower dams do so based on only their energy capacity and consequently ignore other factors during the licensing decision that might contribute to environmental impacts. In Brazil, for example, there are cases of small hydropower dams producing the same amount of power, but varying greatly in the sizes of reservoirs behind them. This kind of discrepancy happens because most classifications ignore measurements of a dam's physical footprint, height or whether it has a reservoir behind it.

The Cangpinghe hydropower facility in China produces 9.1 megawatts of power. ***Naicheng Wu***

"It was surprisingly difficult to find scientific articles that have rigorously quantified the individual and cumulative impacts of small hydropower. This is a critical research frontier for the future," said Julian Olden, senior author and UW professor of aquatic and fishery sciences.

"Individually, large hydropower dams will always cause greater environmental impacts, but with rapid growth of the small hydropower sector, our rivers might just suffer from many small cuts."

It was not too long ago that the world turned to developing small hydropower plants. The trend toward small dams began in Europe in the mid-1980s and has grown rapidly in recent decades. Small dams are ideal for rural areas because they don't have to be connected to the electric grid to power homes and businesses. As a result, many private landowners and corporations can leverage easier environmental permitting to build small hydropower dams for a fraction of the time and cost of large dams.

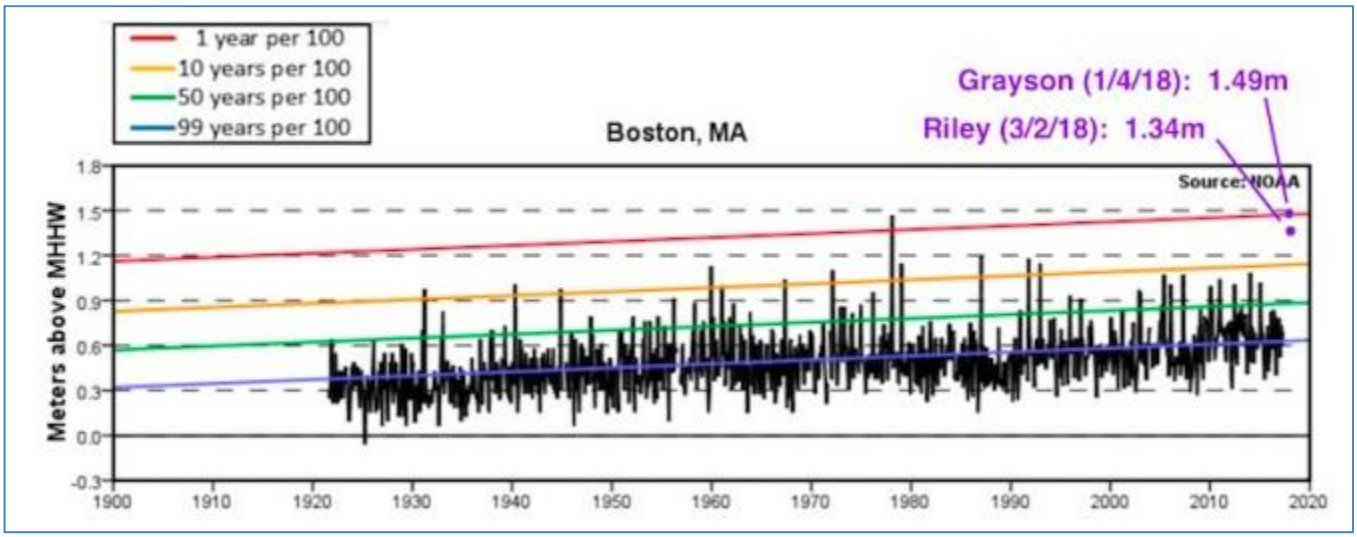
The researchers say more research is needed to understand the cumulative effects of many small dams on the landscape, especially given the rapid pace of development. But in the meantime, they advocate for a standard definition of "small" dams that include more than just generation capacity so that regulations and policies can be applied more rigorously.

"I think one of the most important results of this paper is to show that the development of the small hydropower sector is actually happening in many regions of the world," Couto said. "There is a proliferation of small dams and not much known about how multiple dams affect watersheds as a whole, so that's where science has a key role to play."

The researchers will contribute to that work this spring when they start to study the ecological effects of multiple small hydropower dams in southern Brazil.

This research was funded by the H. Mason Keeler Endowed Professorship and CNPq (Science without Borders). For more information, contact Couto at coutot@uw.edu and Olden at olden@uw.edu.

TWO BLOCKBUSTER EVENTS IN THE SPACE OF TWO MONTHS By Bob Henson · March 5, 2018
https://www.wunderground.com/cat6/weaker-gulf-stream-means-trouble-coastal-new-england.
In records going back to 1921, here's how the two big nor'easters of 2018 rank in terms of water levels in Boston Harbor:
—Grayson (1/4/18): 4.88' above MHHW (mean higher high water), **highest on record**; previous record 4.82' on 2/7/1978 during the infamous Blizzard of '78
—Riley (3/2/18): 4.4' above MHHW, **third highest on record**, behind only the Blizzard of '78 and ahead of the 3.92' observed on 1/2/1987.

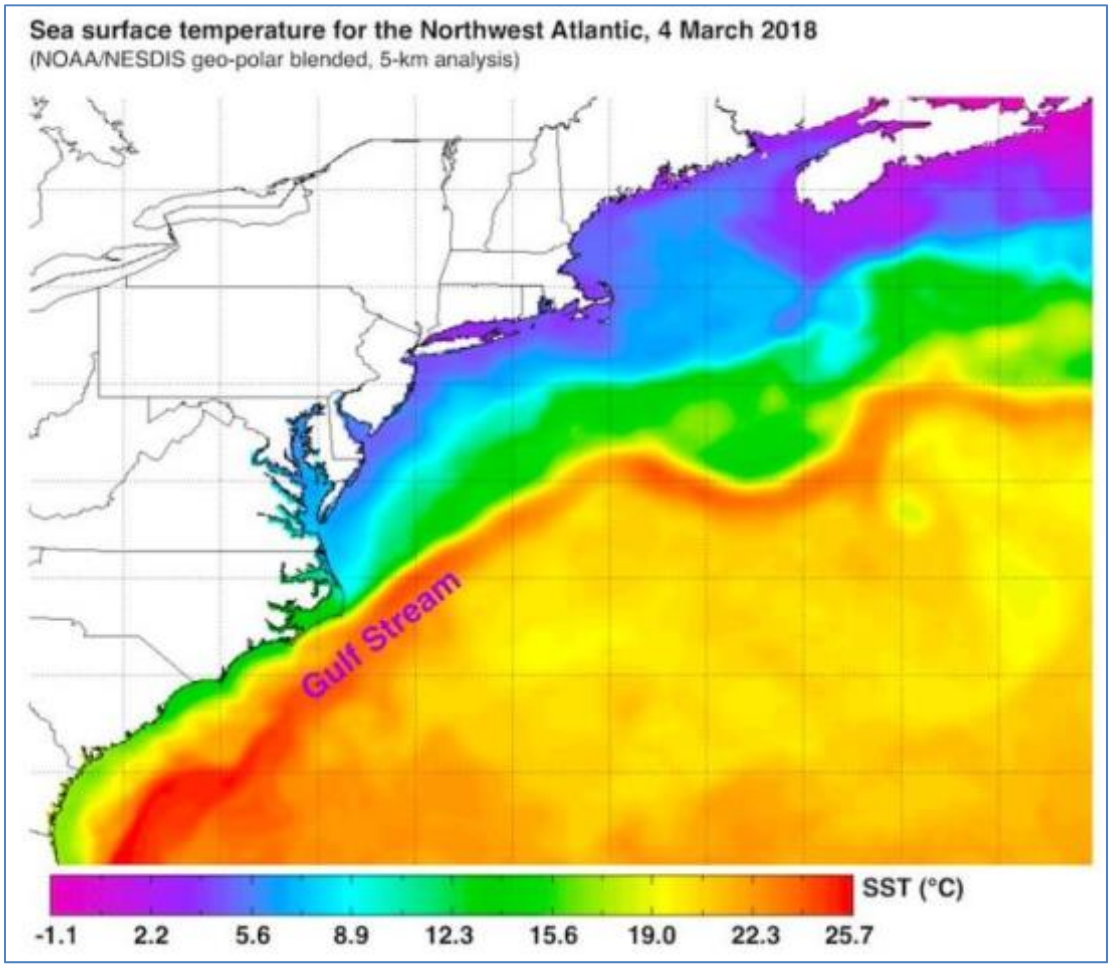


Extreme water levels in Boston Harbor since 1921. Added on the right-hand side are the water levels achieved by Winter Storm Grayson in January (1.49 meters) and Winter Storm Riley in March (1.34 meters). The plots show the monthly highest and lowest water levels with the 1%, 10%, 50%, and 99% annual exceedance probability levels in red, orange, green, and blue. The plotted values are in meters relative to the Mean Higher High Water (MHHW) or Mean Lower Low Water (MLLW) datums established by CO-OPS (1 foot = 0.3 meters). On average, the 1% level (red) will be exceeded in only one year per century, the 10% level (orange) will be exceeded in ten years per century, and the 50% level (green) will be exceeded in fifty years per century. The 99% level (blue) will be exceeded in all but one year per century, although it could be exceeded more than once in other years. Image credit: NOAA Tides & Currents.

A WEAKER GULF STREAM MEANS TROUBLE FOR COASTAL NEW ENGLAND
By Bob Henson · March 5, 2018 Sea level is expected to rise even faster along the Northeast U.S. coast than in most places around the world, thanks in large part to effects related to a weakening Gulf Stream. The renowned ferocity of nor'easters will thus play out atop a progressively rising sea surface, making coastal impacts progressively worse unless adaptation efforts can keep pace.

A row of homes in Scituate, Massachusetts, is surrounded by high-tide water at midday on Saturday, March 4, 2018. Image credit: Ralph Karl Swenson, Amateur Radio SKYWARN Spotter (N1YHS), via NWS Taunton Skywarn.

A man walks slowly through a flooded sidewalk off Congress Street in Boston, where water was flowing over from Fort Point Channel in the Seaport district, during Winter Storm Riley on Friday, March 2, 2018. Image credit: John Tlumacki/ The Boston Globe via Getty Images.



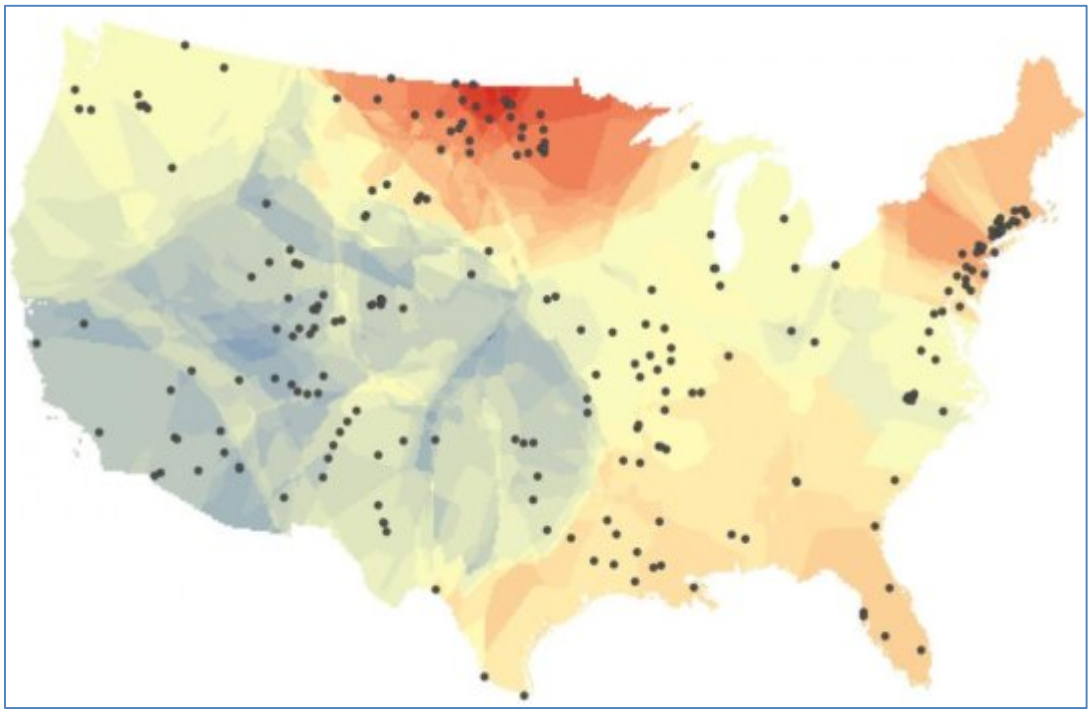
The Gulf Stream is easy to spot in this satellite-based analysis of sea surface temperatures across the Northwest Atlantic on Sunday, March 4, 2018. Sea Surface Temperatures jump from less than 8°C (46°F) to more than 20°C (68°F) across a span of less than 100 miles off the North Carolina coast. Image credit: NOAA/OSPO.

US RIVERS AND STREAMS ARE COMPROMISED BY INCREASING SALT LOADS

https://www.sciencedaily.com/releases/2018/01/180108161213.htm

Materials from Cary Institute of Ecosystem Studies. "US rivers and streams are compromised by increasing salt loads: Better management needed to protect infrastructure, drinking water supplies." ScienceDaily, 8 January 2018.

Human activities are exposing US rivers and streams to a cocktail of salts, with consequences for infrastructure and drinking water supplies. So reports a new study in the *Proceedings of the National Academy of Sciences* that is the first to assess the combined, long-term changes in freshwater salinity and alkalization across the country.



This map shows changes in the salt content of fresh water in rivers and streams across the United States over the past half century. Warmer colors indicate increasing salinity while cooler colors indicate decreasing salinity. The black dots represent the 232 U.S. Geological Survey monitoring sites that provided the data for the study.
Credit: Ryan Utz/Chatham University

Using five decades of streamwater data from 232 U.S. Geological Survey monitoring sites, researchers found 37 percent of the drainage area of the contiguous US experienced a significant increase in salinity, with a concurrent increase in alkalization of 90 percent.

Salt ions, damaging in their own right, are driving up the pH of freshwater, making it more alkaline. Both of these variables shape water quality and can influence the stability of pipes and other water delivery infrastructure. For example, when Flint, Michigan switched its primary water source to the Flint River in 2014, the river's high salt load caused lead to leach from water pipes, creating that city's well-documented water crisis.

Co-author Gene E. Likens, president emeritus of the Cary Institute of Ecosystem Studies and a Distinguished Research Professor at the University of Connecticut, Storrs explains, "Long-term monitoring is vital to understanding the pressures facing our nation's freshwaters from increased salt loading, and for guiding strategies that protect drinking water. Road salt, irrigation runoff, and sewage are obvious culprits. But so is acid rain, which can release alkaline salts that compromise the chemical integrity of freshwaters."

Sharp chemical changes were documented in many of the country's major waterways, including the Hudson, Potomac, Neuse, Mississippi, and Chattahoochee Rivers. Many of these rivers supply drinking water for nearby cities and towns, including some of the most densely populated urban centers along the Eastern Seaboard.

Lead author Sujay Kaushal from the University of Maryland, notes, "We created the name 'Freshwater Salinization Syndrome' because we realized it's a suite of effects on water quality, with many different salt ions linked together. We didn't know that before."

Sources of increased salt in waterways vary regionally. In the Northeast, sodium chloride used to maintain roads in winter is a primary culprit. In the Midwest, fertilizers -- particularly those with high

potassium content -- are a major contributor. In other regions, mining waste and weathering of concrete, rocks, and soils releases calcium and magnesium salts into nearby waterways.

Kaushal notes, "Many people assume that when you apply salt to the landscape it just gets washed away and disappears. But salt accumulates in soils and groundwater and takes decades to get flushed out."

The analysis, which has implications for freshwater management and salt regulation strategies, is the first to document a link between increased salinization and alkalization at the continental scale. It is also an important reminder that when different salt compounds combine, their harmful effects can amplify.

"Until now, we didn't fully appreciate the role that different salts play in altering the pH of streams and rivers of our country," Likens said. "Salt content and pH are fundamental aspects of water chemistry, so these are major changes to the properties of freshwater."

"This research demonstrates the value of long-term data in identifying potential threats to valuable freshwater resources," says John Schade, a National Science Foundation Long-Term Ecological Research program director. "Without such long-term efforts, such widespread and significant degradation of water quality by human activities would remain unknown. Now that we know this is happening, we can begin to unravel the causes and develop strategies to mitigate potential effects on public health."

Some strategies for managing road salt pollution already exist, as outlined in the Cary Institute report Road Salt: Moving Toward the Solution. They include pre-wetting salt to allow it to stick to roads, using brine to prevent ice from forming on road surfaces, reducing the salt content of sand, and using pavement sensors and weather information systems to guide salt application.

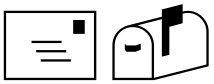
"Also, not all salts are created equally in terms of their ability to melt ice at certain temperatures," Kaushal added. "Choosing the right salt compounds for the right conditions can help melt snow and ice more efficiently with less salt input, which would go a long way toward solving the problem."

The team also notes that urban development strategies -- primarily building further from waterways and designing more effective stormwater drainage systems -- can reduce the amount of salt washed away from weathered concrete. They also recommend monitoring and replacing aging drinking water pipes impacted by corrosion, scaling, or the buildup of mineral deposits and microbial films.

Likens explains, "In the US, many rely on a patchwork of aging pipes to bring drinking water into their homes. Lead in pipes, solder, and joints is not uncommon, especially in our older cities. These pipes are vulnerable to saltier, more alkaline water, which can release toxic metals, such as lead, and other contaminants."

"The trends we are seeing in the data all suggest that we need to consider the issue of salt pollution and begin to take it seriously," Kaushal said. "The Environmental Protection Agency does not regulate salts as primary contaminants in drinking water at the federal level, and there is inconsistency in managing salt pollution at the local level. These factors are something communities need to address to provide safe water for future generations."

Do-doo your dues  – they were due-doo, doo-doo 

in January  . Make checks  payable to

"Geological Society of New Hampshire." 

DATES TO REMEMBER

May 4, 2018 - DEADLINE FOR RECEIPT OF Friends of the Pleistocene REGISTRATIONS
http://www2.newpaltz.edu/fop/index_files/NEFOP_2018_Registration.pdf

June 1-3, 2018 - Northeastern Friends of the Pleistocene 2018 meeting
Mount Desert Island glacial deposits, landforms, and place in the regional deglaciation sequence. http://www2.newpaltz.edu/fop/
Led By: Duane Braun, P. Thompson Davis, Joe Kelley, Jeremy D. Shakun.
DEADLINE FOR RECEIPT OF REGISTRATION IS MAY 4, 2018.
http://www2.newpaltz.edu/fop/index_files/NEFOP_2018_Registration.pdf

September 27, 2018 - Annual Pedro de Alba Lecture in Geotechnical Engineering.
Guest speaker Dr. Harry G. Poulos from the University of Sydney, Australia. Also planned is a technical afternoon session with Dr. Poulos and another one or two speakers on the topic of deep foundations. Help us update our e-mail list. Jean Benoît, Professor Department of Civil Engineering University of New Hampshire Kingsbury Hall, W 177, Durham, New Hampshire 03824 jean.benoit@unh.edu.
Website for The University of New Hampshire Annual Pedro de Alba Lecture in Geotechnical Engineering - http://unh.edu/geotech/Geotech_deAlba%20Lecture.html

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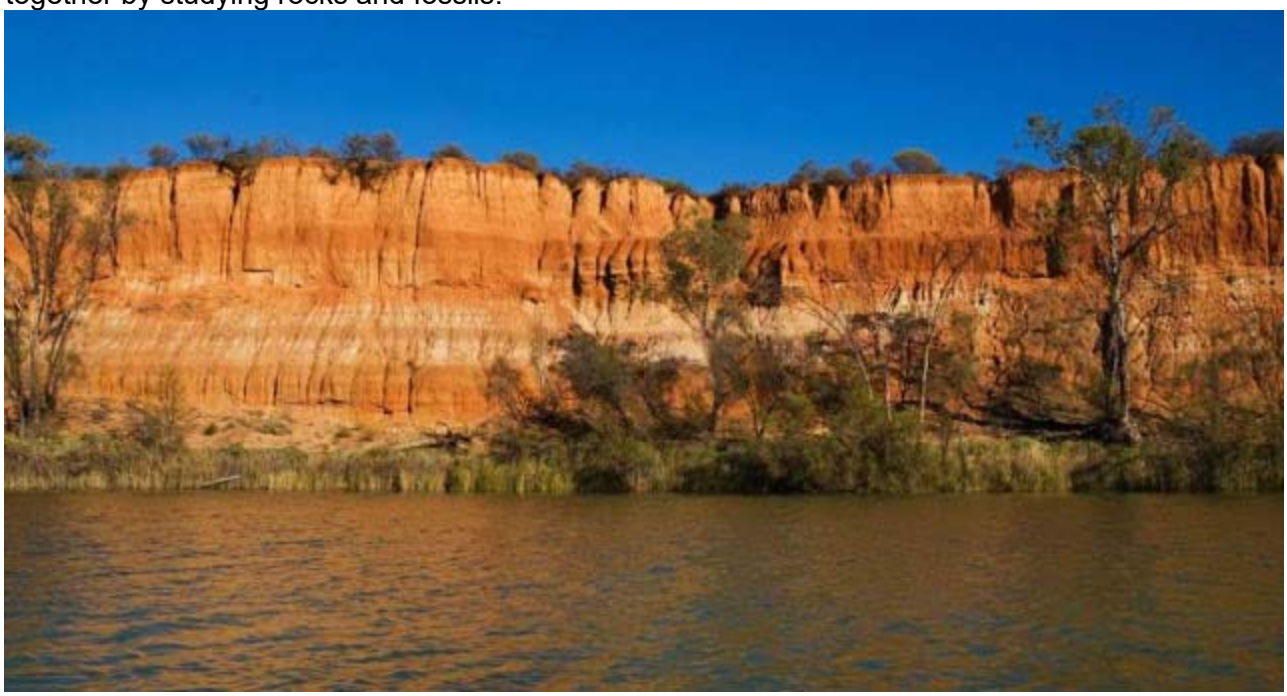
1.7-BILLION-YEAR-OLD CHUNK OF NORTH AMERICA FOUND STICKING TO AUSTRALIA

JANUARY 17, 2018 http://www.geologyin.com/2018/01/17-billion-year-old-chunk-of-north.html

Researchers believe Australia was part of North America 1.7B years ago

Geologists tend to agree that, billions of years ago, the configuration of the continents was very different. How exactly they all fit together and when is a bit more of a puzzle, the pieces of which can be put together by studying rocks and fossils.



Scientists discover a piece of America in northern Australia

Now researchers have found a series of rocks that show something surprising: part of Australia could have once been connected to part of Canada on the North American continent, around 1.7 billion years ago.

Actually, the discovery that the two continents were once connected isn't hugely surprising. Speculation about such a connection has existed since the late 1970s, when a paper proposed a connection dating back to the continent of Rodinia, around 1.13 billion years ago. However, an exact time and location for the connection has remained under debate.

Found in Georgetown, a small town of just a few hundred people in the north east of Australia, the rocks are unlike other rocks on the Australian continent. Instead, they show similarities to ancient rocks found in Canada, in the exposed section of the continental crust called the Canadian Shield.

This unexpected finding, according to researchers at Curtin University, Monash University and the Geological Survey of Queensland in Australia, reveals something about the composition of the ancient supercontinent Nuna. "Our research shows that about 1.7 billion years ago, Georgetown rocks were deposited into a shallow sea when the region was part of North America. Georgetown then broke away from North America and collided with the Mount Isa region of northern Australia around 100 million years later," said Curtin PhD student and lead researcher Adam Nordsvan. "This was a critical part of global continental reorganization when almost all continents on Earth assembled to form the supercontinent called Nuna."

The last time the continents were close to one another was the major supercontinent known as Pangea, which broke apart around 175 million years ago. However, before Pangea, the planet went through a number of supercontinent configurations - one of which was Nuna, also called Columbia, which existed from around 2.5 billion to 1.5 billion years ago.

The team reached its conclusion by examining new sedimentological field data, and new and existing geochronological data from both Georgetown and Mount Isa, another remote town in north east Australia, and comparing it to rocks from Canada. According to the research, when Nuna started breaking up, the Georgetown area remained permanently stuck to Australia.

This, the researchers said in their paper, challenges the current model that suggests the Georgetown region was part of the continent that would become Australia prior to 1.7 billion years ago. The research also found new evidence that Georgetown and Mount Isa mountain ranges were formed when the two regions collided.

"Ongoing research by our team shows that this mountain belt, in contrast to the Himalayas, would not have been very high, suggesting the final continental assembling process that led to the formation of the supercontinent Nuna was not a hard collision like India's recent collision with Asia," said co-author Zheng-Xiang Li. "This new finding is a key step in understanding how Earth's first supercontinent Nuna may have formed, a subject still being pursued by our multidisciplinary team here at Curtin University." https://pubs.geoscienceworld.org/gsa/geology/article-abstract/526080/laurentian-crust-in-northeast-australia?redirectedFrom=fulltext

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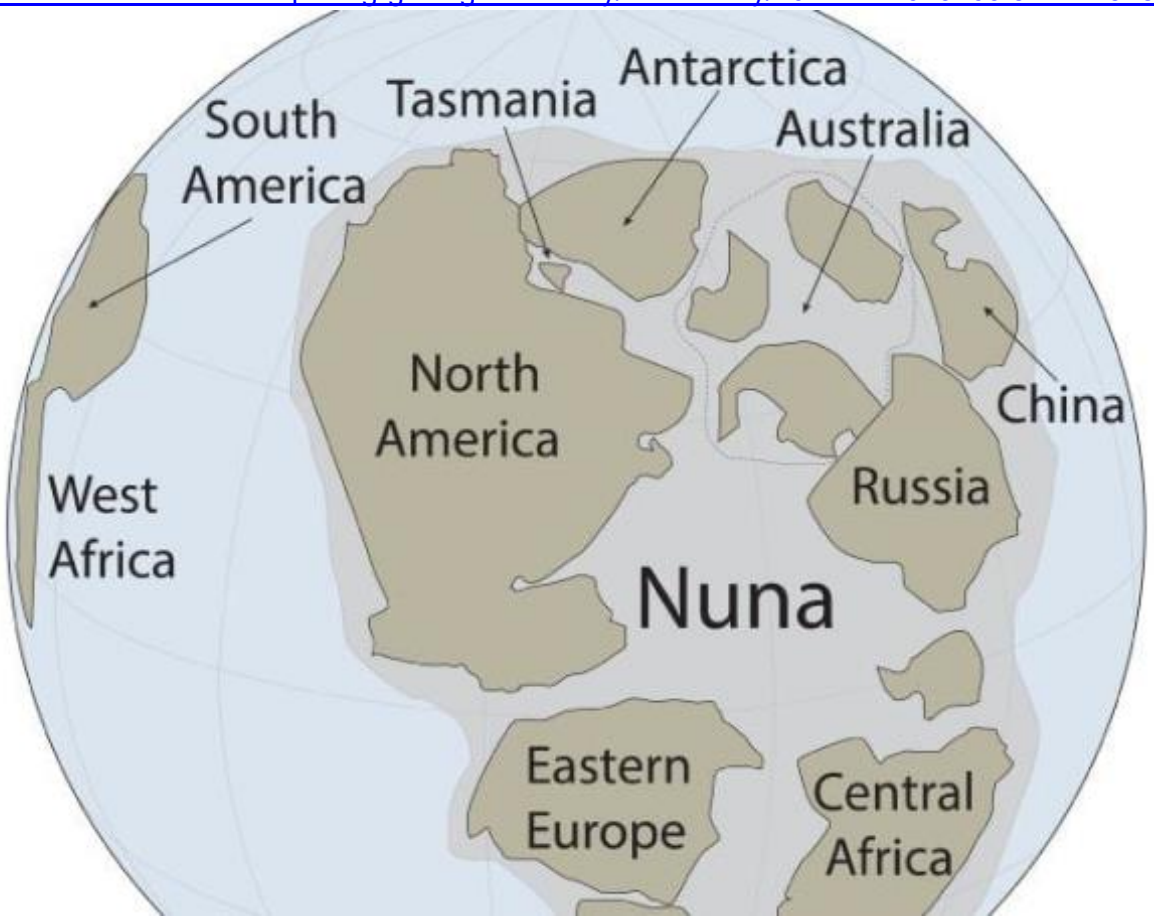
UNIVERSITY OF TASMANIA RESEARCHERS DISCOVER SURPRISING GEOLOGICAL HISTORY SEPTEMBER 9, 2015http://www.news.com.au/national/tasmania/university-of-tasmania-researchers-discover-surprising-geological-history/news-story/10e44eb76e3763f814ebc548ff5fac97



A reconstruction of the supercontinent Nuna shows the hypothesized distribution of continents around 1.45 billion years ago. Tasmania can be seen sandwiched between North America and Antarctica near the North Pole. From a research project by UTAS Ph.D. student Jacob Mulder.

THE NH GEOLOGICAL SURVEY GROUND WATER LEVEL NETWORK SUMMARY

Submitted by Lee Wilder of the NHGS

The NHGS is now posting its monthly groundwater levels from its network of NH Observation Wells online at: http://www.des.nh.gov/organization/commissioner/pip/publications/geologic/groundwater-levels.htm. The data for all of the wells in the NH Groundwater Level Network are shared with and posted on the USGS website at: http://groundwaterwatch.usgs.gov/statemap.asp?sc=33&sa=NH. A map of both the New Hampshire and Vermont Groundwater Level Network is at https://groundwaterwatch.usgs.gov/netmapT2L1.asp?ncd=NHV.

Ossipee Groundwater Level well (OXW-38), right- center. Note the recent selective cutting of red pine. The ridge in the background is a section of the Pine River Esker.
Photo by Lee Wilder, NHGS.

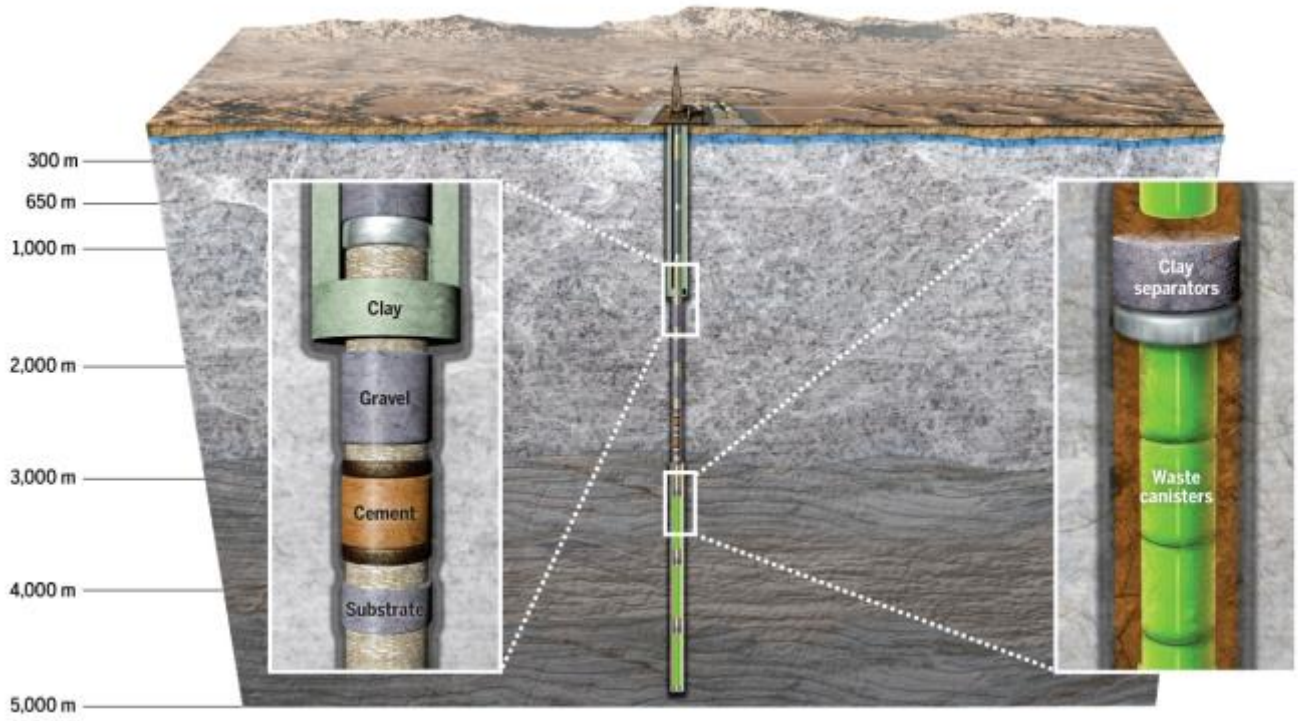
Do-doo your dues – they were due-doo, doo-doo in January. Make checks payable to "Geological Society of New Hampshire."

ENERGY DEPARTMENT SELECTS BATTELLE TEAM FOR A DEEP BOREHOLE FIELD TEST IN NORTH DAKOTA January 5, 2016
https://www.energy.gov/articles/energy-department-selects-battelle-team-deep-borehole-field-test-north-dakota

The U.S. Department of Energy has selected a Battelle Memorial Institute-led team to drill a test borehole of over 16,000 feet into a crystalline basement rock formation near Rugby, North Dakota. This is an important step in exploring the science needed for utilization of deep boreholes in crystalline rock formations. One of the most promising applications is the potential for disposal of certain types of high-level radioactive wastes; another could be geothermal energy development. The field test will provide insights into crosscutting subsurface science and engineering challenges such as drilling techniques, wellbore stability and sealing, and subsurface characterization.

"This is an important first step to increasing our scientific understanding of the potential uses for crystalline rock formations," said Secretary Moniz, "including the feasibility of boreholes as an option for long term nuclear waste disposal."

Over 40 years ago, scientists suggested the idea of disposing of nuclear weapons production waste in holes drilled miles into granite. In January 2012 the Blue Ribbon Commission on America's Nuclear Future recommended research into the possibility of using deep boreholes "particularly as a disposal alternative for certain forms of waste that have essentially no potential for re-use."



Boreholes envisioned for holding highly radioactive waste would be far deeper than proposed or existing underground disposal. In one version, waste canisters would sit in the lowest part of the hole (right, inset). Niccole R. Fuller from http://www.sciencemag.org/news/2016/09/protests-spur-rethink-deep-borehole-test-nuclear-waste

Determining the feasibility of deep borehole disposal is the goal of the DOE's estimated $35 million, five-year project on approximately 20 acres of state-owned land. This research will include examination of the hydrogeological, geochemical, and geo-mechanical characteristics of the host rock at considerable depth. Researchers will collect extensive data during drilling and will allow for specialized scientific testing after drilling is complete. No radioactive material will be used during any of the testing for this borehole project.

Scientists have identified many regions in the United States that have large, geologically stable rock formations similar to the Rugby, North Dakota location. The work in North Dakota will help increase understanding of similar locations across the country.

Members of the winning team are:

Battelle Memorial Institute, Columbus, OH
University of North Dakota Energy & Environmental Research Center, out of Grand Forks, ND
Schlumberger, Houston, TX
Solexperts, Monchaltorf, Switzerland.

http://www.sciencemag.org/news/2016/09/protests-spur-rethink-deep-borehole-test-nuclear-waste

[AND YOU SHOULD ALSO KNOW . . .] DoE'S "DEEP BOREHOLE DISPOSAL" SCHEME TARGETS 26 STATES FOR HIGH-LEVEL WASTE DUMPS! January 5, 2016
http://www.beyondnuclear.org/radioactive-waste-whatsnew/2016/1/5/the-latest-radioactive-rabbit-hole-does-deep-borehole-dispos.html

As announced by a U.S. Department of Energy (DOE) press release, a consortium headed by Battelle Memorial Institute has been awarded a $35 million taxpayer-funded contract to drill a deep borehole, more than three miles down, into the crystalline granite of Rugby, ND.

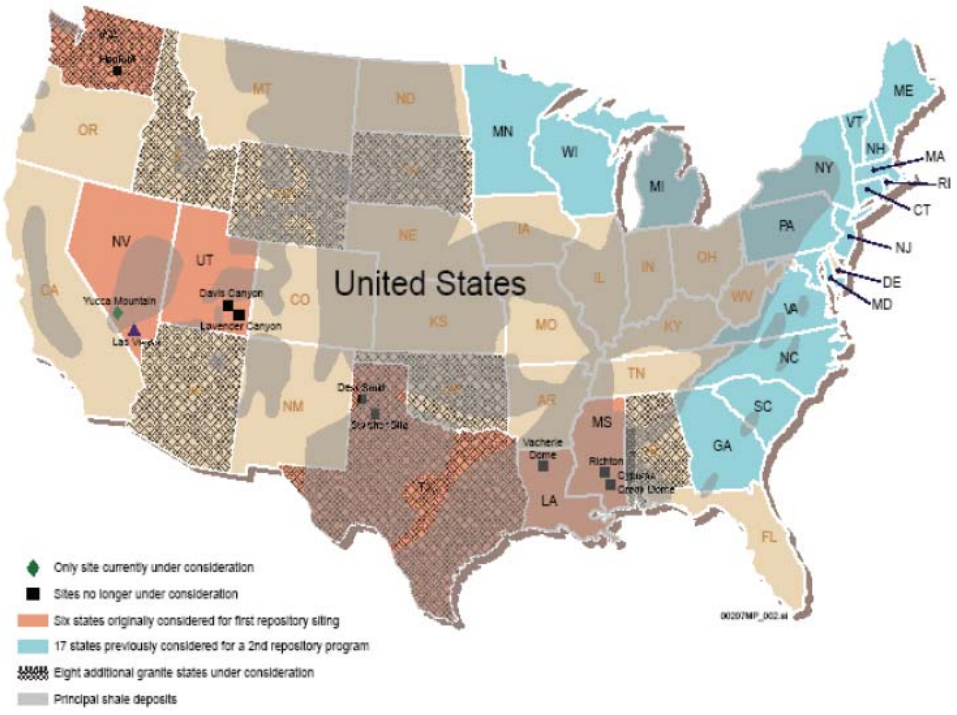


Figure 3. Map of the United States Illustrating First Repository Program Sites, Second Repository Program Areas Under Consideration, and Shale Deposits Potentially Suitable for a Repository

The experiment's overriding *raison d'etre* is to learn lessons that could be applied elsewhere. As DOE's press release concludes:

Scientists have identified many regions in the United States that have large, geologically stable rock formations similar to the Rugby, North Dakota location. The work in North Dakota will help increase understanding of similar locations across the country.

Figure 3 on pdf page 16 of DOE's 2008 report[1] shows that each of the Lower 48 states is under consideration for the second high-level radioactive waste dump. 25 of those states are being targeted because of their granite geology.

DOE reference documents...identify 17 states within which there were granitic bodies believed to be adequate for investigation for siting a repository for the second repository program. The states identified included: [Minnesota; Wisconsin; Michigan; Maine; New Hampshire; Vermont; Massachusetts; Connecticut; Pennsylvania; New York; New Jersey; Delaware; Maryland; Virginia; North Carolina; South Carolina; Georgia.]

And sure enough, as reported by Nancy West in the *NH Business Review* on Dec. 10, 2015, a New Hampshire state law from 1986, banning high-level radioactive waste burial in the Granite State, was very quietly repealed in 2011 -- by a line or two of legislative language, buried in a massive state budget bill. The legislative maneuver was so secretive, that it is still not known which NH legislator(s) orchestrated it, or why.

[1] http://www.energy.gov/sites/prod/files/edg/media/Second_Repository_Rpt_120908.pdf

WHY SOME COMETS BREAK UP, THEN MAKE UP By Jim Scott

"Some comets are like couples—they break up, but then they get back together down the road," says Distinguished Professor Daniel Scheeres of the Ann and H.J. Smead Department of Aerospace Engineering Sciences. Scheeres teamed up with colleagues from CU Boulder, Purdue University and several other institutions to discover that the bodies of some comets that orbit the sun may split and reunite in a repeating process fundamental to comet evolution.

The team studied a rubber duck-shaped comet known as 67P that has two cracks, each longer than a football field, on a neck that connects its two large lobes. The team used numerical models to show that when the comet spun fast enough —comets can spin up or spin down for various reasons— it increased stress and the crack sizes enough to pop the head off. But the models show the head and body can't escape each other. In weeks, days, or even hours, they will come together again, creating a new comet nucleus.

https://www.colorado.edu/research/report/2016-17/why-some-comets-break-then-make

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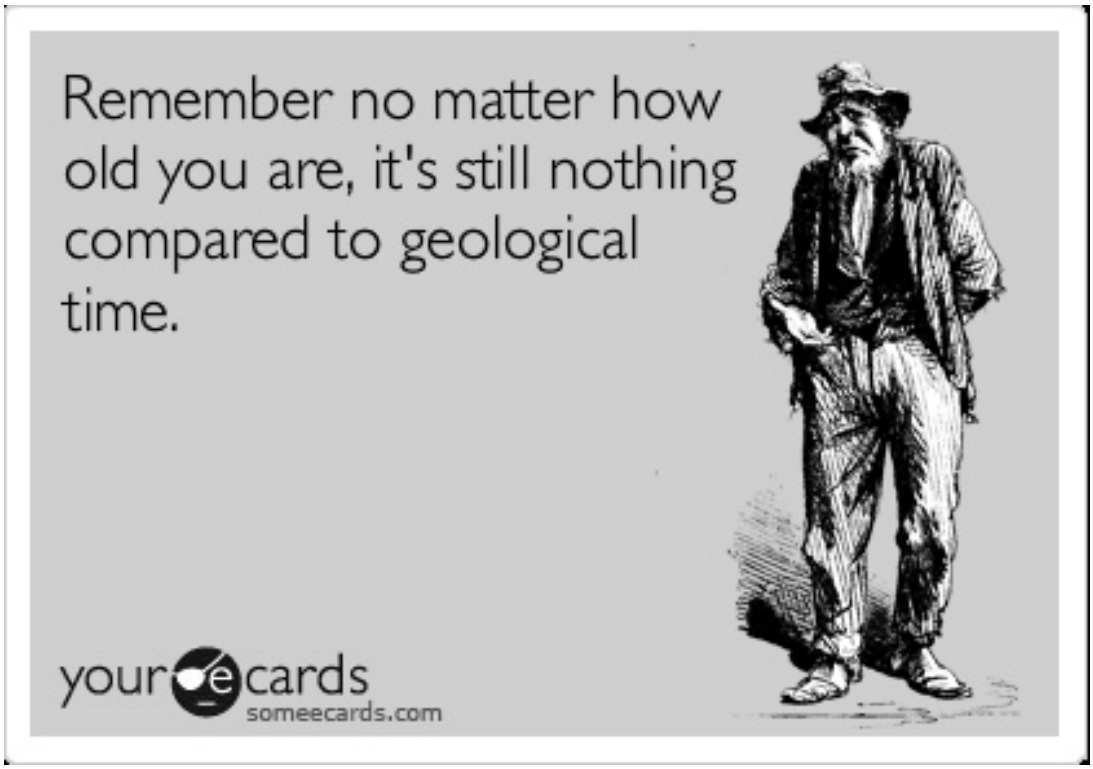

POPULAR ALASKA PEAK WEIGHS NEW RULES FOR CLIMBERS' POOP By Dan Joling – AP Feb 28, 2018 http://www.seacoastonline.com/zz/shareable/20180228/popular-alaska-peak-weighs-new-rules-for-climbers-poop

Climbers on North America's tallest mountain may have to start packing out more of their poop after a researcher determined a glacier in which much of it has been dumped over the past decade probably is not decomposing the human waste.

Michael Loso, a glacier geologist, calculates that 36,000 climbers between 1951 and 2012 deposited 152,000 to 215,000 pounds (69 to 97 metric tons) of feces onto Kahiltna Glacier, part of the most popular route to Denali's summit.

For more than a decade, the National Park Service has required that climbers keep waste off the Alaska mountain's surface. Mountaineers captured their poop in biodegradable bags held by portable toilets and pitched it into deep crevasses on the glacier.

However, Loso's research indicates human waste never reaches the bottom of the glacier, will never be exposed to extreme temperatures and disintegrate, and likely will reappear downstream as stains on Kahiltna Glacier's surface where melting exceeds annual snowfall.

In this April 15, 2002, file photo, members of the U.S. Army's High Altitude Rescue Team from Fort Wainwright Army Base near Fairbanks, Alaska, unload supplies from the team's CH-47 Chinook helicopter for the National Park Service's 7,000-foot level Mount McKinley base camp on the Kahiltna Glacier near Talkeetna, Alaska. The National Park Service is considering new rules for the disposal of human waste generated by climbers on the North America's tallest mountain, Denali. (AP Photo/ Al Grillo, File)

Park Service officials say the dumping of human waste that does not decompose is not a practice they want to continue in a national park and a wilderness area. "These changes are in direct response to the research," Chris Erickson, a mountain ranger, said by phone from nearby Talkeetna. The proposed regulations would allow mountaineers to drop waste in only one crevasse at high elevation. They would have to carry out the rest.

Human waste is a concern on most mountains that attract multitudes of climbers, and the issue of poop littering the routes up Mount Everest in Nepal is well-documented. Some mountains are trying to minimize the human waste problem. In Japan, bio-toilets have been set up along the route to Mount

Fuji's summit, and incinerator toilets are situated at the top. In Tanzania, latrines have been built for climbers making their way to Kilimanjaro's summit.

The waste can be more than just bothersome. Climbers on Denali, 130 miles (210 kilometers) north of Anchorage, get all their drinking water by melting snow. And snow contaminated by human excrement can spread dangerous bacteria such as E. coli, causing climbers intestinal distress and diarrhea leading to dehydration, a life-threatening condition at high altitude.

Denali is the centerpiece of Denali National Park, a sprawling expanse of forestland, tundra, glaciers and snowy peaks. Each year about 1,100 people try to reach its summit at 20,310 feet (6,190 meters). More than 90 percent use a route that starts from a landing strip for small airplanes on Kahiltna Glacier.

Starting in 2007, the Park Service required that human waste be collected in "Clean Mountain Cans," a portable toilet invented by a Denali park ranger that looks like an extended coffee can. Under current rules, climbers between the base camp and 15,000 feet (4,572 meters) are allowed to toss filled liners into crevasses. Rangers even marked safe places to do so.

Loso for more than a decade has studied Denali human waste management to determine whether feces broke down, and if not, where it went. He buried human waste, dug it up after a year and found it remained at temperatures just below freezing, without undergoing temperature extremes or ultraviolet light that kills bacteria.

"For most bacteria, that's a really comfortable place to be," Loso said.

He forecasts that poop could emerge soon on the glacier surface 7 miles (11 kilometers) below the base camp, where the surface melts faster than snow accumulates.

The area is so remote, future visitors are unlikely to see the emerging waste, but Loso's findings motivated the Park Service to re-examine its rules. The agency also doesn't want pollution reaching the Kahiltna River, which flows from the glacier.

Under proposed rules, all Denali dung must be deposited in one of two places: the ranger station at Talkeetna or in a crevasse at "Camp Four," a campsite at 14,200 feet (4,330 meters). Waste dumped there tumbles down a huge ice cliff and is likely to be pulverized and rendered inert, said Erickson, the mountain ranger.

Tom Kirby, a guide for American Alpine Institute, said his company supports any effort to get the waste problem under control.

"I think that's a pretty reasonable thing to do to promote cleanliness and to keep water coming out of Kahiltna Glacier reasonably clean," he said.

Colby Coombs, owner of Alaska Mountaineering School, which guides visitors on Denali, said he fully supports the Park Service balancing the safety of climbers, who want to move quickly through dangerous terrain without extra weight, while protecting a wilderness area within a national park.

"Who would like to see a big pile of human waste?" he asked. "That's disgusting.

A UPDATE ON WHAT'S GOING ON IN THE ARCTIC OCEAN AND WHY YOU SHOULD CARE

Much more and links at https://meam.openchannels.org/news/meam/skimmer-very-quick-update-whats-going-arctic-ocean-region-and-why-you-should-care

The Arctic had air temperatures in February that climbed above freezing at the North Pole making it 30° C warmer than normal. At the same time, Europe went into a deep freeze. Why? Climatologists think these weather anomalies are related and are due to a weakening of the "polar vortex."

Primary production has increased in the Barents and Eurasian Arctic seas because sea ice is breaking up earlier in the year, allowing sunlight to reach the upper layers of the ocean and stimulate plankton blooms.

You should care because one of the features of current global climates is the circulation of air and ocean currents between the cold Arctic and warmer parts of the Northern Hemisphere. This circulation is driven by the temperature difference between the areas. With a warming Arctic and a smaller temperature gradient, this circulation is diminished. Mid-latitude winds ("jet streams") weaken and form wavier patterns, slowing down the passage of weather systems. This leads to extreme weather stagnating over places for long periods such that warm weather becomes prolonged heat waves, dry weather becomes droughts (creating conditions ripe for wildfires), and rainfall events cause flooding.

The Geological Society of New Hampshire

Dr. Ken Galli
Boston College
Earth and Environmental Sciences

"New CA-TIMS Dates of Late Jurassic Volcanic Eruptions Reduce the 'Time of Dinosaurs' in Western Colorado"

April 12, 2018
Pappas Room, Puritan Backroom, 245 Haskett Road, Manchester, NH
https://www.puritanbackroom.com

Geological Society of New Hampshire

Topic: New CA-TIMS Dates from the Brushy Basin Member, Morrison Formation, Western Colorado, USA: Implications for Dinosaur Evolution
Speaker: Dr. Kenneth Galli, Boston College

Thursday, April 12, 2018
Location: Puritan Backroom (Pappas Room), Manchester
5:30 pm Social Hour - 6:30 pm Dinner - 7:15 pm Speaker Presentation

RSVP by 4 pm Friday, April 6, 2018 to get the reservation price
SPACE AT THIS VENUE IS LIMITED T0 80...RESERVE EARLY!

Advance Reservations: _____Member (Dues Paid) $25.00
_____Non-member $28.00

_____Please indicate the number of vegetarian meals – leave blank for none.

- Member at the Door $27.00
- Non-Member at the Door $30.00
- Students $10.00 with valid student ID card (Reservation Requested)

GSNH will also accept dinner reservations by e-mail, which will then allow you to pay at the door. Please note that e-mail reservations constitute an agreement with the Society for which you will be responsible to pay, whether you are able to attend or not, unless you cancel your reservation by noon the Tuesday before the Dinner.

Reply via e-mail to: sharon.lewandowski@aecom.com.
Mail to: **Sharon Lewandowski**
GSNH Dinner Meeting, PO Box 401, Concord, NH 03302.
Checks payable to: GSNH.

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The lecture part of the program counts as 1.5 hours of CEU contact hour credit.

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Geological Society of New Hampshire

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__ Other:

Membership Category:

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Make checks payable to **"Geological Society of New Hampshire."** Note that GSNH dues are not deductible as a charitable contribution, but may be deductible as a business expense. Please return this completed application form with any necessary corrections and a check for the appropriate dues to the GSNH at the address above. The Society's membership year runs from January 1 to December 31.

Signature: _____ Date: _____