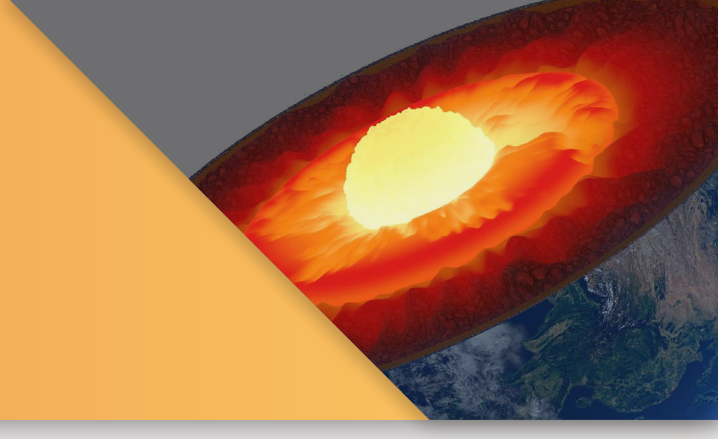
UTAH FORGE NEWSLETTER

AT THE CORE



OCTOBER 2022

Word from the PI

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Word from the PI

Recently, the U.S. Department of Energy expanded its series of Energy Earthshots to "accelerate breakthroughs of more abundant, affordable, and reliable clean energy solutions within the decade." The Enhanced Geothermal Shot aims to reduce the cost of Enhanced Geothermal Systems by 90%, to $45 per megawatt hour, by 2035. This is only possible if we're able to de-risk EGS.

Utah FORGE plays a pivotal role in de-risking EGS through tool testing and new technology development. To help further these necessary advancements, in August, we announced Solicitation 2022-2, up to $44 million in funding for five topic areas from proppants and packers to seismicity and stimulation schemes. You can read more about it here.

Congratulations to everyone at Geothermal Rising for putting on a great conference. It was rewarding to see so many colleagues from around the world and share insights and new learnings. Among the many excellent technical sessions, were two separate FORGE-centered tracks, and several other presentations included Utah FORGE data. As a reminder, all our data is available through our Wiki site.

In August, Utah FORGE was honored to have U.S. Senator Mitt Romney of Utah visit the site. Senator Romney and several of his key staff members had an opportunity to learn about the project first hand. We greatly appreciate the Senator's continued commitment and support to the project.

In Memoriam

It is with immeasurable sadness that we face the sudden passing of our dear colleague and friend Phil Wannamaker. He was an electromagnetic geophysicist second to none, active in basic and applied geophysical research for 30 years. He published over 50 papers and advised more than 20 graduate students. His dedication and vital contribution to the project was invaluable. Phil will forever be missed.

Technical Discoveries

Over the last few years, we have been analyzing helium isotopes in groundwaters accessed by shallow wells in the region surrounding the Utah FORGE site. Unexpectedly, a large mantle helium anomaly was revealed in the middle of North Milford Valley, covering more than 200 km^2 (Fig. 1). So why is this important? After all, mantle helium has been identified in groundwaters in volcanic regions, including the Cascades, Japan and elsewhere. Before answering this question, it is useful to supply some background.

Helium is a noble gas that occurs in low concentrations in the atmosphere and hydrosphere as well as in crustal and mantle fluids. Being unreactive, it provides a unique and powerful tool in tracing the origins of fluids based on measurement of the ratio of the two isotopes, ^{3}He and 4He. The most abundant one, ^{4}He, derives from radioactive decay of uranium and thorium, whereas 3He is rare, and related to the origin of the earth. Accordingly, helium reservoirs have distinct isotopic compositions. The atmospheric 3He/4He value is 1.4 x 10^{-6}, and it is commonly designated as Ra. By contrast, helium coming from the mantle is ~8 times Ra, whereas helium in the continental crust is ~0.01 times Ra. The disparity in the values of isotopic ratios makes it possible to distinguish differences in the sources of helium. For example, mantle helium signatures are associated with thermal waters in volcanic terrain having a magmatic heat source, whereas crustal signatures are associated with radiogenic heat sources, and atmospheric signatures are associated with near surface groundwaters.

In summary, mantle derived helium is a characteristic feature of magmatic activity and volcanic gases. At Utah FORGE, the youngest known volcanic eruption occurred over 500,000 years ago

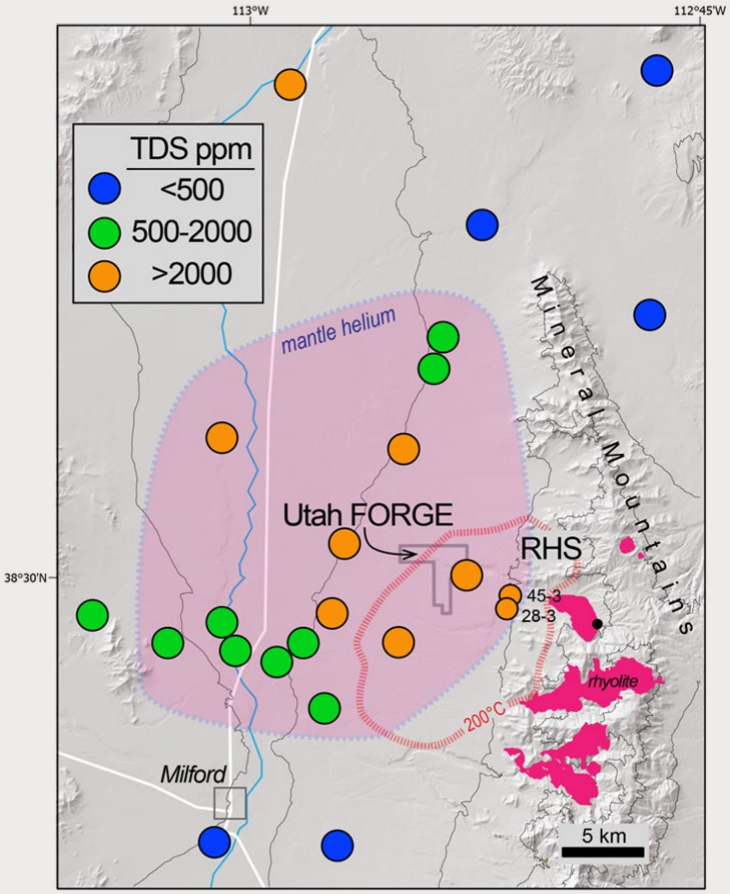

Figure 1. Map of the mantle helium anomaly in pink (R/Ra from 2 to 2.5) as detected in shallow groundwater wells (filled circles) in the North Milford Valley and deep geothermal wells (28-3, 45-3) at Roosevelt Hot Springs (RHS). The orange, green and blue filled symbols represent ranges of total dissolved solutes (TDS) in groundwaters, and those in orange trace the shallow subsurface outflow from Roosevelt Hot Springs. The rhyolite domes occur in the core of the Mineral Mountains. The red dashed line marks the 200°C isotherm at 3000 m depth.

producing a series of small rhyolite domes in the core of the Mineral Mountains. Despite the age, the Roosevelt Hot Springs hydrothermal system, which supplies the Blundell geothermal power plant, has long been viewed as being associated with this volcanic activity, primarily because the production fluids have a mantle helium signature. This is consistent with geophysical data suggesting the existence of hot molten material at more than 10 km depth.

Back to the original question, there are three interesting aspects of the mantle helium anomaly in the North Milford Valley groundwater wells.

Technical Discoveries (cont)

The first is the uniformity of the isotopic ratios between 2- and 2.5-times Ra, which is the same as that measured at Roosevelt Hot Springs. This suggests a common magmatic source in the form of a felsic melt body similar in composition to the rhyolite that erupted over 500,000 years ago. Second is the extent of the He anomaly which greatly exceeds the dimensions of the geothermal anomaly based on what can be deduced from surface geology, heat flow and deep drilling. Thirdly, the anomaly is offset from the center of maximum heat flow which encircles the region encompassing the Utah FORGE site and Roosevelt Hot Springs. These aspects might lead one to infer that the mantle helium groundwater anomaly in North Milford Valley is the product of subsurface outflow originally sourced from Roosevelt Hot Springs; however, the pattern and area of the helium anomaly extends well beyond the edges of the outflow plume, requiring separate subvertical flow paths of deep sourced helium.

One exciting conclusion is that magma is much more extensive than previously known or expected. Furthermore, additional geothermal resources may lie concealed beneath the surface beyond the limits of Utah FORGE and Roosevelt Hot Springs.

Importantly, we can now say with confidence that what makes the Utah FORGE a cost-effective laboratory for EGS research is the high conductive heat flow in crystalline rocks that is expressed as ancient volcanism and modern plutonism.

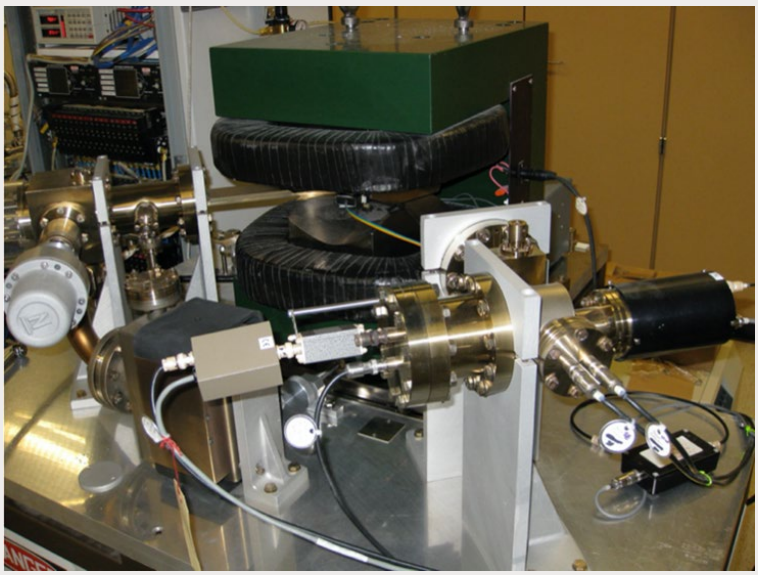

Figure 2. Helium isotope analyses are measured on a high precision mass spectrometer like the one shown at the Noble Gas Laboratory housed in the Department of Geology and Geophysics, University of Utah, run by Professor Kip Solomon.

Featured Publication

Daniel WELLS, Fan-Chi LIN, Kristine PANKOW, Ben BAKER, John BARTLEY. "Combining Dense Seismic Arrays and Broadband Data to Image the Subsurface Velocity Structure in Geothermally Active South-Central Utah." Link

Outreach

The Utah FORGE Communication and Outreach team hit the road to talk about the project and geothermal energy with stakeholders from kids to scientists!

First up, the team hosted an informational booth at the annual Midvale (Utah) Harvest Days Festival. Midvale is a suburb of Salt Lake, and celebrates its long history the first weekend of August. The event was our first foray outside of Beaver County or the geothermal community. Even with torrential thunderstorms, over 160 people visited the booth to learn about our research and geothermal energy.

As everyone knows, we're proud to be part of the University of Utah, one of the finest universities in the country. In late August, students come back to campus, and the U holds Welcome Week – a time for students to learn about clubs, organizations and other aspects of the University. Along with our student interns, the Communication and Outreach team talked about the University's leadership in geothermal energy and the Utah FORGE project. Over the course of the three days we were there, more than 300 students and some faculty stopped by, including Taylor Randall, the school's president!

The Beaver County Fair is always one of the highlights of the summer, and Utah FORGE hosted a booth again this year. It was great fun to have kids stop by and tell us they remembered us from the previous year, while picking up their own rock kit packet, which included a piece of granite rock, an info sheet, and a magnifying glass. We were honored to have members of the City Council and County Commission, the winners of our song parody contest, along with so many from neighboring towns come by our booth.

Outreach (cont)

Following the Fair, the Communications and Outreach team traveled to Reno, Nevada for the Geothermal Rising Conference. With over 500 participants stopping by the booth to learn about the latest advancements at Utah FORGE, we were certainly one of the most popular destinations for attendees.

Finally, it was great to be back at Utah's STEM Fest this year. Armed with some awesome hands-on-modules and a thermal camera, the team explained heat transfer and the basics of geothermal energy to eager young minds from around Utah. More than 13,000 students attended this year's event!

Remember to follow us on Twitter, Facebook and LinkedIn to stay up to date on the latest outreach news!

Modeling and Stimulation Forum

This is a monthly forum-like meeting for the modeling and simulation scientific community.
A one-time registration is required. Details are available on the Modeling and Simulation page.
Next monthly community update is October 19, 2022.

Utah FORGE Geothermal Webinar Series

Coming in October!

Introducing a new webinar series on new Geothermal Technologies breakthroughs. Check out the information page (LINK) for schedules and upcoming topics and for registration links.

Upcoming Events

Did You Know...

Renewable Energy Corridors Can Be the Future of Energy Production?

In the Escalante desert of southwestern Utah, near the town of Milford, there are four different types of renewable energy: wind, solar, biogas, and geothermal. They're all being used to produce energy at the same time. The co-location and concentration of such diverse renewable resources in the North Milford Valley is unique, and it serves as a model of what other renewable energy corridors might be able to achieve around the country. (read more)