January 28. 2022

One year after landing - An update on the Mars 2020 Perseverance rover's mission to Jezero crater, Mars

Prof. Joel Hurowitz

The Mars 2020 Perseverance rover landed in Jezero crater on Mars on February 18, 2021. Since that time, the Mars 2020 rover science team has conducted field reconnaissance and analysis of two major geological units on the floor of Jezero crater and collected 7 samples (1 atmospheric sample and 6 rock samples) that will eventually be returned to Earth for further, in-depth analysis. Her companion, the Ingenuity helicopter, conducted the first ever powered, controlled flight by an aircraft on another planet, and continues operating as a scout vehicle for the rover. This update will discuss Perseverance and Ingenuity's operations, the discoveries that have been made using the rover's scientific instrument payload, and what the precious samples collected by the rover might teach us about the geological and astrobiological history of the Red Planet.

Joel Hurowitz is a geochemist and planetary scientist working on the exploration of Mars and the study of modern and ancient Mars analog environments on Earth. He is the deputy principal investigator of one of seven instruments, called PIXL, which was selected for the science payload of the Mars 2020 rover mission. Dr. Hurowitz received his Ph.D. from Stony Brook University working under the supervision of Dr. Scott McLennan. He was a Caltech postdoctoral scholar at the Jet Propulsion Laboratory in 2006–2007 working with Dr. Albert Yen. From 2007 to 2013, Dr. Hurowitz was a research scientist at the NASA Jet Propulsion Laboratory. In 2013, he joined the faculty of the Department of Geosciences at Stony Brook University where he is an assistant professor.

February 25. 2022

Mineral alteration in gas/oil shale during fracking

Prof. Qingyun Li

You may have heard a lot about clean energies these days, which goes disproportional with the fact that we still use fossil fuels as the primary energy source. The conventional way of getting gas and oil from underground – drilling a vertical well and starting production - contributes less and less to the overall production. In the US, two-thirds of the gas and half of oil is produced with the unconventional procedure called fracking, or hydraulic fracturing. In the unconventional operation, drilling a vertical well is not sufficient. The wellbore needs to turn horizontal when it reaches the reservoir depth. Afterward, thousands to tens of thousands of cubic meters of water-based fluid have to be injected down the wellbore to frack the tight reservoir, creating fractures to allow gas and oil to flow back to the surface.

The injected water triggers mineral dissolution and precipitation. This dynamic process changes water chemistry, which in turn changes minerals reactions. Meanwhile, paths for gas/oil to get out of their rocky home are altered. What are these mineral reactions and how do they happen? Hear more details and see the invisible in today's Open Night talk!

Qingyun Li is an Assistant Professor of geochemistry in the Department of Geosciences at Stony Brook University. She uses experimental approaches, geochemical modeling, and synchrotron X-ray techniques to study water-rock interactions in energy and environmental applications.

March 25. 2022

Returning Samples from Mars:

After 50 Years of Planning, Will it Finally Happen?

Prof. Scott McLennan

Returning samples from the surface of Mars has been a major goal of planetary science since the early success of the Mariner and Viking missions in the 1960s and 1970s. Mars has generously delivered her own samples to Earth in the form of >100 Martian meteorites, but apart from the single brecciated find *Northwest Africa(NWA)7034* (and its various "pairs"), it is evident that these meteorites do not provide representative sampling of the Martian crust and are unlikely to answer the crucial question of whether or not life ever arose on that planet. Early reports of fossil microbes within the oldest of these Martian meteorites, *Allan Hills(ALH)84001*, have not withstood subsequent scrutiny. Landing spacecraft on Mars, triaging, collecting and packaging samples, and safely returning them to Earth in a manner (mandated by international treaty) that guarantees the biological integrity of both planets is technologically challenging in the extreme. Nevertheless, in the wake of spectacularly successful recent Mars exploration that identified and characterized ancient habitable geological settings that could be the sites of past life, two developments have brought a Mars Sample Return Campaign (MSR) to the forefront for both NASA and ESA. The first development was the National Research Council identifying the first mission towards MSR as the highest priority for the 2013-2022 Planetary Science Decadal Survey, leading to the Mars 2020 mission and the Perseverance rover landing on Mars just 13 months ago and currently assembling caches of samples in Jezero crater. However, MSR requires three missions plus an entirely unique type of sample return facility on Earth and the financial and technical difficulties are so challenging that it requires a level of international cooperation rarely seen in planetary exploration. Accordingly, the second crucial development took place in Berlin in 2018 in association with the 2nd International Mars Sample Return Conference where NASA and ESA signed a memorandum of understanding giving the "green light" to jointly mounting a Mars Sample Return Campaign. A concerted program of planning and development is now underway. This lecture will review the current state of planning for MSR and describe the missions that will follow on from Perseverance and that will be used to finally achieve the goal of returning a scientifically compelling suite of Mars samples to Earth as early as 2031.

Scott McLennan is a Distinguished Professor in the Department of Geosciences, Stony Brook University, specializing in geochemistry and planetary science. He received his PhD in 1981 from the Australian National University, where he also conducted post-doctoral research (1981-1986), and has been a faculty member at Stony Brook since 1987. Professor McLennan has been involved with Mars research since 1999 and a member of the science teams for six Mars missions (Spirit, Opportunity, Odyssey, Curiosity, InSight, Perseverance). He has also served on several NASA committees involved with Mars sample return planning, including co-chairing the 2011 NASA-ESA-sponsored international science analysis group (E2E-iSAG) that formulated science priorities and mission requirements for a Mars Sample Return Campaign.

April 22. 2022

TBD

Prof. Weisen Shen