ROCKS UNLOCKED

Scientists abuzz with excitement as NASA makes new lunar samples available after nearly 50 years

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The world is a wondrous place. Sometimes it's easy to forget that. Fortunately, many major cities offer a place you can go to remember: the natural history museum.

Among artifacts like dinosaur fossils and taxidermy dioramas, you might find a "Hall of Gems" or similar exhibit. Brimming with brilliant diamonds, rare rubies and amazing amethysts, it reminds you that no matter how unremarkable they might appear, there's more to rocks than meets the eye.

That's especially true of moon rocks, hundreds of pounds of which Apollo astronauts harvested during America's six moon landings between 1969 and 1972. As it celebrates the 50th anniversary of the first — Apollo 11, which collected about 20 rocks and 13 pounds of lunar soil — NASA has launched the Apollo Next Generation Sample Analysis program, or ANGSA. The goal: "maximize the science derived from samples returned by the Apollo program in preparation for future lunar missions."

As part of the program, NASA will unseal three samples that have been carefully stored and completely untouched for nearly 50 years. Although no one knows what secrets they may hold, their release is an occasion to celebrate the insight that other samples have already offered on humanity's most cosmic questions.

Astronaut Harrison Schmitt heads out to collect rocks during the Apollo 17 mission of December 1972, the last manned moon landing. One of the samples collected on the mission was vacuum-sealed on the moon and will soon be opened. NASA

Foreign yet familiar

By definition, moon rocks are otherworldly. And yet, they're strikingly similar to rocks on Earth.

"The moon is made from the same stuff as the Earth, so it actually has a very similar geology," says Sarah Noble, a planetary geologist working on ANGSA. She says lunar geology encompasses two primary types of rocks: basalts and anor-

thosites. “When you look at the moon at night, you can basically see that there are bright parts and dark parts. The dark bits — what we call ‘mare’ — are basalt.” The bright parts are anorthosite, she says, “and are actually all one mineral, called plagioclase feldspar.”

According to Noble, lunar basalt is similar to the volcanic rock that’s abundant in Hawaii, while anorthosite is the same mineral that makes up the white parts of granite kitchen countertops.

Lunar lessons learned

All told, Apollo astronauts brought home 2,200 lunar samples — 842 pounds of rocks and soil. They reside mostly in the Lunar Sample Laboratory Facility at NASA’s Johnson Space Center in Houston.

“They are stored under nitrogen atmosphere in special cabinets to protect them from terrestrial contamination, and they are handled very carefully by the curatorial staff, using special tools,” says Juliane Gross, associate professor of Earth and planetary sciences at Rutgers University and a 2013 participant in NASA’s Early Career Fellows program.

Gross calls NASA’s lunar samples “the most dramatic and exciting result of the Apollo missions,” which explains the strict conditions under which they’re stored and studied. They’ve helped scientists answer one of humanity’s most pressing existential questions: Where did we come from?

“Ever since humans started to be curious about Earth and other planets, we have wanted to learn everything about the early processes of planetary formation,” Gross says. “Unfortunately, we can’t look at very old rocks from that time period on Earth because Earth is a very active planet, and all the old geologic evidence that we could have used to satisfy our curiosity is gone. The moon is our nearest neighbor and is largely inactive, and therefore represents the best and most accessible place to study the planet-altering processes that have shaped our corner of the solar system.”

Rocks are “little history books,” echoes Noble, who says the composition of moon rocks has uncovered a fascinating narrative about the origin of the moon. “What we think happened is that a planet the size of Mars ran into the early Earth and knocked off a bunch of material that coalesced together to form the moon,” she says. “It was very hot, and very violent.”

Scientists theorize that the same impact that took a bite out of early Earth 4.5 billion years ago also imprinted it with elements like carbon, nitrogen and sulfur, which eventually spawned life. Moon rocks have therefore revealed as much about humanity as they have astronomy.

Top: **The Apollo 11 astronauts — from left, Buzz Aldrin, Michael Collins and Neil Armstrong — look at one of the rocks they brought back from the moon. It was being given to the Smithsonian at this event in September 1969.** ***Above:*** **Daniel Anderson inspects a basketball-size rock brought back by Apollo 14 in early 1971.**

TOP, CHARLES HARRITY, AP; ABOVE: NASA

Coming soon: New discoveries

Moon rocks also have helped scientists calibrate the instruments they use for remote sensing of the lunar surface. They’ve helped refine the science of age-dating planetary surfaces. And studying moon rocks has allowed scientists to better recognize lunar meteorites, whose composition can shed more and different light on astronomical questions given their diverse points of origin spanning the entire lunar surface — including the far side of the moon that never faces Earth.

Thanks to ANGSA, scientific literature soon will swell with even more insights mined from moon rocks. Although the new samples likely won’t be made available until sometime in 2020, preparations already are underway. In March, for instance, NASA announced nine research teams from academia and government that will receive access to the fresh lunar material. One sample — 1.8 pounds of material encased in a “drive tube” that was pounded into the lunar surface — was vacuum-sealed on the moon by Apollo 17 astronauts Harrison Schmitt and Gene Cernan. Another, also from Apollo 17, was brought to Earth, then kept frozen. The final sample, from Apollo 15, has been stored in helium since 1971.

Noble offers multiple reasons for unsealing the samples now. One is technology, which has advanced such that scientists can now examine samples with new granularity and precision. Another is talent; by exposing a new generation of scientists to lunar samples, NASA can gain new perspectives while also training young researchers to process future samples. Which leads to the third and final reason: With new moon missions on the horizon — the first of which is envisioned for 2024 — fresh samples could be coming soon.

“I am so very excited and extremely happy that NASA has made this choice,” Gross says. “This is an amazing opportunity for the next generation of lunar scientists.

“Who knows what sort of new geological processes we will unravel, what type of new rocks we might encounter, what new things we will learn about the Earth-moon system. The possibilities are endless.”