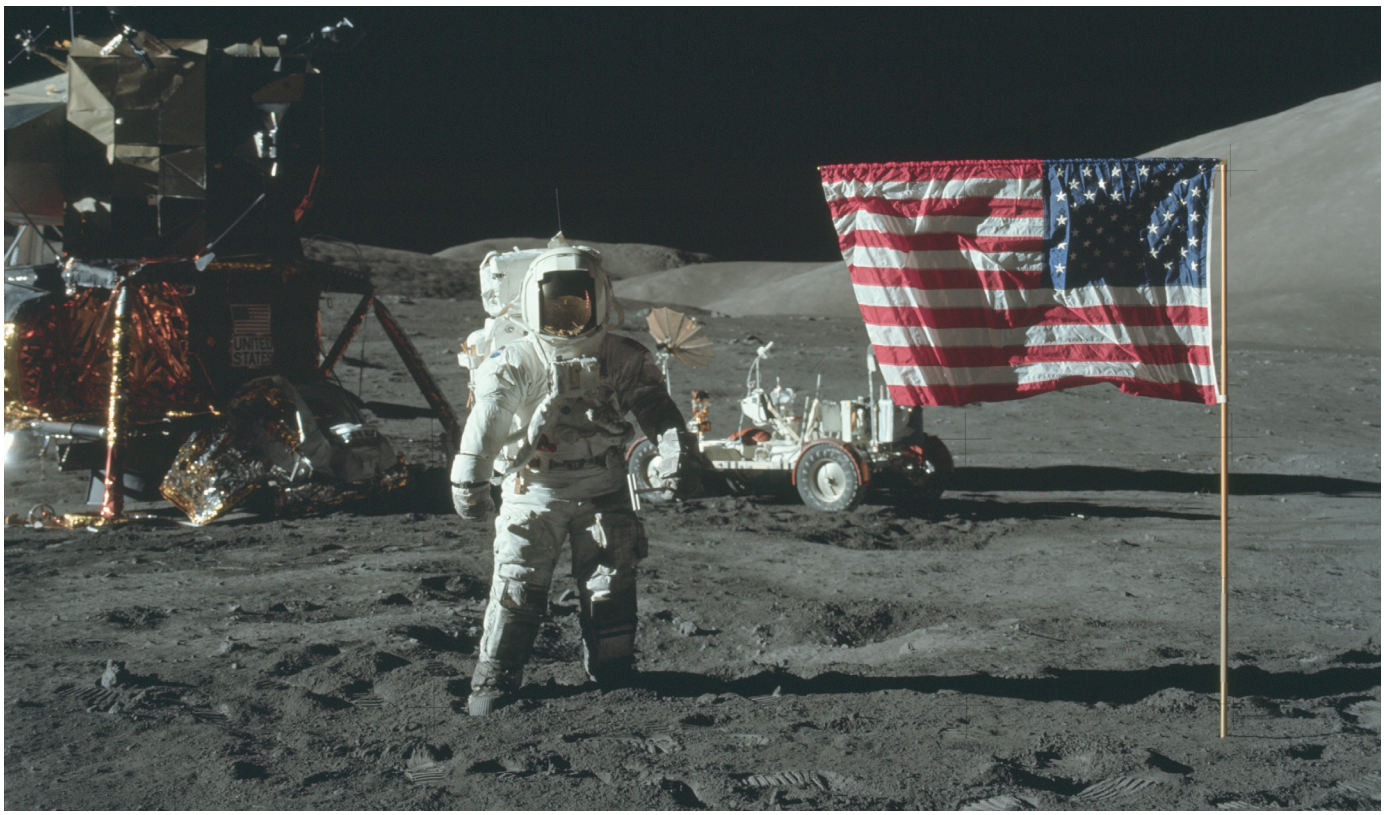
NEWS IN FOCUS

NASA



NASA's Apollo 17 mission to the Moon collected rock samples that scientists hope to unseal for study in the coming year.

PLANETARY SCIENCE

Fresh look at Moon rocks reveals Solar System secrets

Latest analyses of Apollo samples could guide a new era of lunar exploration.

BY ALEXANDRA WITZE IN THE WOODLANDS, TEXAS

At some point in the coming year, curators at NASA's Johnson Space Center in Houston, Texas, will don protective suits and gloves, enter the high-tech laboratory that houses the United States' trove of Moon rocks and open a long metal tube that has been sealed since 1972. That's when Apollo 17 astronauts pounded it into the ground in the Moon's Taurus-Littrow Valley to collect rocks.

It will be the first time in decades that anyone has opened a pristine Apollo sample. "One should consider this a new mission to the Moon," says Chip Shearer, a geologist at the University of New Mexico in Albuquerque who plans to study the core using the latest laboratory techniques. Getting information from the decades-old core "is really a continuation of Apollo and a bridge to our future", he said on 20 March at the Lunar and Planetary Science Conference in The Woodlands, Texas.

Fresh studies of Apollo-era samples could help to shape the next generation of lunar geological discoveries, researchers said at the meeting. Scientists are applying modern techniques to analyse the 382 kilograms of Moon rocks that astronauts retrieved between 1969 and 1972, and using insights from historical and modern Apollo studies to decide the next set of sites on the lunar surface to explore.

The timing is serendipitous, because NASA plans to begin flying scientific instruments to the Moon's surface as early as next year — its first venture there since 1972. Researchers ▶

should push to get as much science as possible out of those missions, for example by insisting that they go to mostly unexplored targets, such as the Moon's far side, David Kring, a planetary scientist at the Lunar and Planetary Institute in Houston, said at the meeting. Other nations are also racing to the Moon; in January, a Chinese probe made a historic touchdown on the Moon's far side, and last month, an Israeli company launched the first private Moon lander.

PLUMBING THE PAST

Moon rocks have helped scientists to pinpoint the dates of key events throughout the 4.5-billion-year history of the Solar System, such as the asteroid bombardment thought to have happened about half a billion years after Earth formed. "The lunar crust is really a museum of planetary science," said Juliane Gross, a planetary scientist at Rutgers University in Piscataway, New Jersey.

Some insights have come from looking at Apollo-era rocks in new ways. Beck Strauss, a planetary geophysicist at the US National Institute of Standards and Technology in Gaithersburg, Maryland, described hunting for faint magnetic fields in 3.1-billion-year-old rocks gathered by Apollo 12 astronauts. Strauss's research confirms earlier hints that the Moon's magnetic field strength peaked between 3.9 billion and 3.6 billion years ago and then dropped — which suggests that something must have changed in the lunar interior, where the ancient magnetic field evolved in unknown ways. "New techniques give us access to things that were not possible during the Apollo era," they said.

Glassy beads in some of the Apollo Moon rocks — which formed during volcanic eruptions — are also yielding discoveries. Megan Guenther, an undergraduate student at the Massachusetts Institute of Technology in Cambridge, has tried to replicate the chemical conditions under which the black glass beads in Apollo 14 rocks probably formed. She found that the beads could have formed at up to 900 kilometres deep, which is much deeper than scientists had suspected.

"One should consider this a new mission to the Moon."

Green glass beads from Apollo 15 rocks also tell a story about the primordial Moon, said Evelyn Füri, a geochemist at the French national research agency CNRS in Vandœuvre-lès-Nancy, France. Her team has analysed neon and other gases inside 22 of the tiny beads and found that two of the beads are particularly gas-rich (E. Füri *et al. Geochem. Persp. Lett.* **8**, 1–5; 2018). Those gases might be relics from the early days of the Solar System, which would support the idea that the Moon has managed to hang on to some of the volatile materials that many researchers thought it had lost altogether (A. E. Saal *et al. Nature* **454**, 192–195; 2008).

Shearer and his colleagues will look for hints of those volatile compounds when they open the long-sealed Apollo 17 core. Astronauts collected it from rocks piled up by a landslide at the base of a small mountain in the Taurus-Littrow Valley. They pounded the core-collection tube deep enough to penetrate frozen soil, and the rock sample could still contain water or other volatile substances that were once trapped beneath the landslide. If so, researchers will be able to measure the volatile substances much more precisely than they could have 50 years ago, and start to answer lingering questions about how the Taurus-Littrow Valley — which is as deep as the Grand Canyon — formed.

Opening a lunar sample is always a thrill, says Andrea Mosie, a curator at the Houston facility. She still remembers processing her first Apollo sample decades ago, wearing three sets of gloves and working in a nitrogen-filled glove box. "Just to pick it up was really exciting," she says, "because I was picking up a piece of the Moon." ■

GLACIOLOGY

Ancient Antarctic ice holds record of Earth's climate

International team plans to extract column containing 1.5-million-year-old ice.

BY QUIRIN SCHIERMEIER

Geoscientists are getting ready to dig up ice that is older than anything ever excavated before.

After two years of extensive reconnaissance in Antarctica, an international team of researchers is set to drill for a core that is likely to contain ice at least 1.5 million years old, and that should reveal details about the planet's ancient climate.

The Beyond EPICA project, which the European Commission is expected to fund with about €11 million (US$12.5 million) in grants, is set to start formally in June.

Next year, scientists on the team, which includes 12 groups from 10 European countries, plan to set up camp in an area of East Antarctica called little Dome C (see 'Drilling deep'), and start drilling to the bottom of the 2.75-kilometre-thick ice sheet at a site there.

DRILLING DEEP

European researchers will next year head to an area of East Antarctica called Dome C to start drilling to the bottom of the 2.75-kilometre-thick ice sheet and extract a core of ancient ice.

"I'm absolutely thrilled," says principal investigator Carlo Barbante, a climate scientist at the Ca' Foscari University of Venice in Italy and at the National Research Council of Italy. "This iconic project will help us better understand climate change in the past and to come."

MILLENNIA OF ICE

Ice that has accumulated undisturbed over millennia preserves samples of the world's ancient atmosphere, creating a continuous climate record with high temporal resolution. Existing records from Greenland and Antarctica shed light on what drives Earth's glacial cycles, and how climate fluctuations correlate with atmospheric levels of greenhouse gases.

Deep cores drilled by the European Project for Ice Coring in Antarctica (EPICA) more than a decade ago cover the climate