Doubtful method to ‘save’ Grévy’s zebra (p. 34); here, a capture is made
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Table of Contents

Cover: Failing to outrace a pursuing vehicle in Kenya, this endangered Grévy’s zebra is about to be lassoed, moved 300 miles away in an attempt to “save” it (p. 34) Photograph by John Reader

The view from the castle: Secretary Ripley’s comments

Letters to the Editor

Picture credits

Phenomena, comment and notes by James K. Page jr.

Around the Mall and beyond by Edwards Park

Violent roundup of Africa’s rare Grévy’s zebra is spectacular to observe, but the cost is high in injury and death

Article and photographs by John Reader

Bernard Berenson—a scholar, high priest of culture and agent extraordinary—is the subject of an extensive exhibition at the National Gallery of Art

By Alexander Eliot, photographs by Dmitri Kessel

The versatile Roger Stevens, guiding force of the Kennedy Center, has turned the capital into a “good show town”

By Tom Prideaux, photographs by Yoichi R. Okamoto

Our older cities are showing their age but also showing signs of fighting back (second of a series)

By Richard L. Williams, photographs by Ralph Morse

As insects increase in numbers despite use of chemicals, Integrated Pest Management is farmers’ new weapon

By Daniel Jack Chasan

Photographs by Christopher Springmann

In Winston-Salem the arts are put in their place—out front

By Bennett Schiff, photographs by Yoichi R. Okamoto

Naming the moon’s features created “Ocean of Storms”

By Farouk El-Baz, illustrations by W. B. Park

Bioethicists of Hastings Center discuss and recommend action concerning matters of life and death

By Jane Stein

Book reviews

Additional reading

January events at the Smithsonian

Smithsonian tours

Shed a tear, and a quarter, for 5¢ bars

By Richard L. Williams
Naming moon’s features created ‘Ocean of Storms’

By Farouk El-Baz

It all started with Galileo 370 years ago. When the great Italian scientist trained a crude telescope on the moon, he saw—and began mapping—the mountains, valleys and craters. He was the first to call the bright highlands *terrae* (the lands) and the dark regions *marea* (seas). And thus began the often tumultuous history of classifying and naming the features of the moon.

Galileo became caught up in conflict with the Church, but scores of astronomers followed his lead, observing and charting the moon. Each observer gave names to the features he observed and, by the end of the 17th century, more than 25 maps had been produced.

A 1645 map by a Belgian engineer and mathematician known as Langenus, court astronomer to the king of Spain, named many of the 300 features shown for Spanish kings and nobles. A Danzig city counselor and astronomer who was called Hevelius chose names already used for terrestrial features: he named lunar mountains and chains after ranges on Earth, for example the Apennines and Caucasus, and the craters we know as Copernicus he called Mount Etna after the volcano.

The most lasting scheme was that of Ioannes Riccioli, an Italian Jesuit who in 1651 published the lunar map based on observations by his pupil, Francesco Grimaldi. Riccioli gave the dark plains romantic names like Sea of Tranquility, Ocean of Storms and Bay of Rainbows. Like Langenus he named the craters for famous people, but instead of kings he chose philosophers, astronomers and other scientists. The names were arranged in chronological order from north to south, and he grouped nationalities, interests, schools of thought and the like in the same areas. Greek scientists and philosophers were in one group, Arab astronomers in another.

Riccioli did not admit that Copernicus was right and the Earth orbited the sun

Galileo’s first glimpse through a telescope gave us a whole new world to name. Now everybody who was anybody in science is there.
(although some historians think he secretly believed that it did). Thus, the name of Copernicus was, as he put it, "flung into the Ocean of Storms." In this same ocean we find, on a tiny, undistinguished crater, the name Galileo.

On the other hand, the Jesuits gave Ptolemaeus, whose idea of an Earth-centered universe was blessed by the Church, a prominent crater near the center of the visible lunar disk. The name of the Danish astronomer Tycho Brahe, who had rejected the Copernican system, was placed on a very bright crater in the southern hemisphere. Also, Riccioli and Grimaldi named two huge, dark-floored craters after themselves.

Riccioli's scheme has lasted to this day. But, in the centuries between, astronomers using better telescopes produced more and more detailed maps of the moon. Johann Schröter added 70 names, and Wilhelm Beer and Johann Mädler used an additional 140 when they published a map more than three feet across. In the latter half of the 19th century more new maps were drawn that added still more names, and also changed earlier ones. Confusion reigned.

In 1921 many of the professional astronomers of the world formed the International Astronomical Union (IAU), which in turn named a committee to standardize lunar nomenclature. Eleven years later an official map and catalog were published, leaving still unnamed many of the thousands of features visible through large telescopes.

Who really cares? What could matter less than the name assigned to some crater visible only through a telescope? I have learned through firsthand experience that naming the moon brings into play passionate views of normally cool-headed scientists, emotions of an interested public, even international politics.

The Space Age multiplied the problems. Just two years after Sputnik, the Soviet spacecraft Luna 3 photographed the far side of the moon, our first view of that whole hemisphere. Jubilant, the Soviets proposed to use Russian names for all the visible features. The IAU had no rules for naming discoveries made by spacecraft, and now there was a whole new moon to be named.

Craters were to be named for scientists, and it was not difficult to approve names like Sergei Korolov, a rocket scientist; Dmitri Mendeleev, who gave us the periodic table of the elements; and Konstantin TsioIkovsky, the physicist who suggested space stations.

The dark plains were to be named for states of mind, but the Soviets wanted to call the largest plain on the far side of the moon the Sea of Moscow. Delegates protested, until a Soviet representative stood up and declared: "Moscow is a state of mind." Everyone laughed, but the name was approved.

The United States did something of the same when we began giving names to features revealed by the Lunar Orbiter photographs taken in 1966-68, the most detailed ever obtained up to then. An IAU working group appointed to name far-side features considered recommendations primarily from the United States, along with a few from France, the Soviet Union and other countries. One Russian proposal was flatly rejected when doubts

Illustrations by W. B. Park
German astronomers played a major role in lunar map making, and some of their names now grace craters.

were raised as to whether the feature existed at all. At issue was a broad, bright zone on the far side; the Russians wanted to call it the Soviet Mountains. But mountain ranges on the moon are the rims of huge basins which encircle the dark plains or maria, and no such basin appeared on Orbiter photographs of the area.

Furthermore, the Apollo 8 astronauts returned from their flight around the moon with photographs that indicated that the bright zone must have resulted from the confluence of rays, bright streaks on the lunar surface, radiating from two craters.

The Russians were right, however. In the detailed photographs from Apollo 16 I saw the subdued remnants of an old basin, about which I published a paper in Science in 1975. The eastern rim of that basin was close enough to what was labeled the Soviet Mountains. Later that year I visited Moscow with a group of scientists as part of the preparations for the Apollo-Soyuz mission. Our talks about cooperation in lunar mapping were not entirely successful, but I did meet Yuri Lipsky, the leading lunar scientist in the Soviet Union. He told me he was the one who had interpreted the bright zone as a mountain range, and that he had been delighted with my Science article. Lipsky died recently, and the IAU placed his name on a far-side crater, not far from the mountains he named.

With the Apollo missions, the United States really took over the naming of the moon.

The astronauts, and we scientists and engineers in the program, had to name certain features for easy reference. No one was concerned about the official status of those names. We felt they were needed for operational reasons and did not require formal IAU approval. In reality, there was no way to gain approval: only a few months—sometimes only weeks—passed between assignment of names and the printing of maps for training and the missions themselves.
When a Soviet spacecraft returned the first pictures of the moon's far side, the Russians naturally started naming the most visible features for Russians.

The IAU met only once every three years. Names used only for features tracked from above to check spacecraft orbits were not much of a problem. Jargon, like 'F1' and 'J5', was used, as were names of astronauts' wives and family members. But the names assigned to features at the landing sites quickly became entrenched in the scientific literature. With no hesitation whatsoever, scientists referred to these names as if they were as good as the ones given by Riccioli. Some argued, "And why not? Riccioli didn't even go to the moon."

The first landing, Apollo 11, did not entail much exploration of the lunar surface. And there was little need for naming craters. One was dubbed West as the astronauts landed on the western edge of their target landing area. At the Apollo 12 site the astronauts named a distinctively arranged cluster of craters Snowman; the crater on top was called Head. A crater with a terrace became Bench; another with a bright rim became Halo.

In training the Apollo 13 astronauts, I described the most prominent crater in their landing site as cone-shaped and it became Cone. Rows of craters were named Doublet and Triplet, and an unusually shaped crater cluster was christened Weird. The names persisted when Apollo 15 failed in flight and Apollo 14 was reassigned to the same site.

As more complex target areas were chosen and exploration plans became more elaborate for later missions, the need for names became more pressing.
and the variety increased. Some craters in the Apollo 15 landing site were given names that described their morphologies, such as Dune and Crescent. But one was named Earthlight, after an Arthur Clarke science-fiction novel. Another was called St. George, named after the wine that Jules Verne’s crew drank before their voyage to the moon.

One crater at the Apollo 15 site was called O.S. It was across a 1,200-foot-deep rill from where the astronauts were to land. They named the crater O.S. because if they landed near it they would have to say, “Oh, shucks, we missed.”

At the Apollo 16 site a small crater became Baby; a group of five was called Cinco; a hazardous area was named Spook; and a crater that appeared ruined by younger events became Wreck.

The site of the final mission, Apollo 17, was the most extensively explored and needed the most names. This crew included a geologist, Harrison (Jack) Schmitt, now a U.S. Senator from New Mexico, who wanted to be sure that scientists were commemorated along with other favorites of the astronauts. So in addition to Shakespeare, Cochrane and Captain Nemo, craters were named for famous geologists and explorers.

Some of the names already had been given to other craters elsewhere on the moon, thus presenting the IAU with an intolerable conflict. The IAU also had to deal with a crater named for Lara, the heroine of Boris Pasternak’s Dr. Zhivago, a choice not popular with the Russians, and two named for Robert E. Lee and Abraham Lincoln despite an explicit prohibition against “political, military and religious figures.”

IAU approval was needed. The names were already being used in the scientific literature while at the same time the National Aeronautics and Space Administration would not use the names on its maps until they had official approval. The job of obtaining IAU approval of these “Apollo names” was given to me. I discussed the matter with the concerned scientists and astronauts, weeded out the list of names to choose important ones, and negotiated the matter with IAU officials. After a year of steady correspondence, I was invited to present the case at the 1973 meeting in Sydney, Australia.

The popular feeling of the IAU membership was that because the names were needed for “operational” reasons, they should remain informal. After my day in court and some reasonable compromises on both sides, I returned from Sydney with the good news: most of the astronaut-given names were now legitimate.

Another decision at Sydney permitted the names of people other than scientists to be used on the moon. Those who sought the change argued that once the names of great scientists were used up, the IAU would have to go to the bottom of the barrel for new names. So why not honor historians, architects, composers, dancers, painters and everyone else who had contributed to human culture?

The Soviet delegation objected vehemently. I found out it was a matter of bureaucracy. As long as names of Soviet scientists were being nominated, the USSR Academy of Sciences would be in charge. But if the door were opened to other professions, other agencies would step in and the Academy of Sciences would lose control, I was told.

The IAU was not to be left alone to wrestle with the lunar naming process. The United Nations, through its Conferences on the Standardization of Geographical Names, argued that the U.N. should contribute to selection of nomenclature for international use, aided by its internationally accepted phonetic alphabet for use in transliterating names from various languages.

The U.S. Board on Geographic Names pointed out that it was charged by law to “formulate principles, policies and procedures to be followed with reference to both domestic and foreign geographic names,” and went on to define the moon and planets as foreign.

NASA named scientists to its Lunar and Planetary Photography and Cartography Committee, which appointed a lunar nomenclature subgroup.

At the same time, the problem was compounded many times over when spacecraft started revealing surface features on Mercury, Venus and Mars and its moons. In the excitement of discovery the nomenclature process began haphazardly. Copernicus and Schiaparelli, among many others, had their names on both the moon and Mars. The American astronomer Gerard Kuiper was commemorated on the moon, Mars and Mercury. Something had to be done—and fast.

The IAU created a working group on Planetary System Nomenclature, chaired by the distinguished Canadian astronomer Peter Millman, which in turn appointed subgroups for the moon, Mercury, Venus, Mars and the outer solar system. They came up with a plan under which features in the outer solar system...
will receive names from ancient mythology. Mars will keep most of its traditional names but its small craters will be named after villages on Earth. On Venus female names will be used, as will names of radio and radar scientists and engineers. Mercury will be reserved for non-scientists, and the moon will remain the place for commemorating great scientists.

Of the scientists immortalized on the moon, the Smithsonian Institution has its share: James Smithson, Samuel Langley, Charles Greeley Abbot, Leonard Carmichael, Donald Menzel and Michael Collins. All of these but the last are no longer alive.

Collins, very much alive, is Under Secretary of the Institution.

Why is his name there? After the landing of Apollo 11, the American delegation to the IAU submitted a list of astronauts to be commemorated. It included the three men who died in the Apollo fire and six living astronauts: the three men who made the first circumlunar flight on Apollo 8 and the astronauts of Apollo 11. To use the names of living people was a painful break from tradition, but the accomplishments of the astronauts could not be ignored. Finally, the Soviet delegation added its support to the proposals—and six names to the list. Thus craters were named for six living American astronauts and six Soviet cosmonauts.

Commemoration is not, of course, the primary purpose of naming lunar features. It is done so investigators can be sure they are referring to the same feature. So there are times when even small features on detailed maps must be named. Following a plan adopted in Sydney, these features are given first names taken from an international list of female and male names. They do not refer to specific people.

Recommendations for naming lunar features are now channeled through two groups. The IAU accepts names from the international community. Those from the American public are processed by the U.S. Board on Geographic Names (in order to be included on any official U.S. map, a name must be approved by the board).

Today new names are placed on lunar features only when absolutely necessary. Although most of the moon has been photographed in varying detail, I am certain that more and better photographs will be obtained in the future. I am a firm believer in the inevitability of continued exploration of the worlds around us. The human race will continue to strive for more knowledge and better living. One day the moon may be a base for exploring the universe, or a source of raw materials for space industrialization. When that day arrives, better maps will be required. Thus I am certain that future generations will have the freedom to make their own mistakes as they have their round of naming the moon.

Perhaps the boldest suggestion of modern lunar nomenclature was to rename the moon itself for Artemis, the moon goddess.
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