Rockfest XIX: Getting around

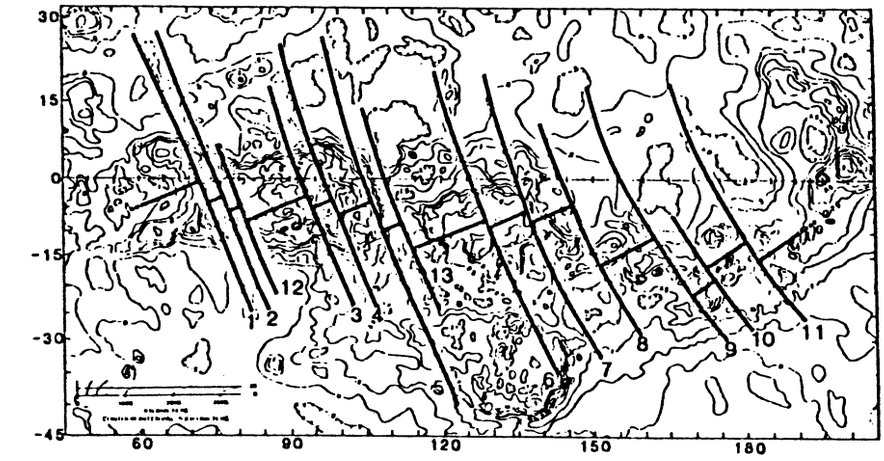
It was 1970 that saw the first "Rockfest," formally known as the Lunar Science Conference, convened at NASA's Johnson Space Center in Houston to present analyses of the pieces of the moon brought to earth by the Apollo astronauts. Held every year since then, its name was changed in 1978 to Lunar *and Planetary*, as other planets, moons, asteroids, comets, meteorites, space dust and more became additional stars of the show.

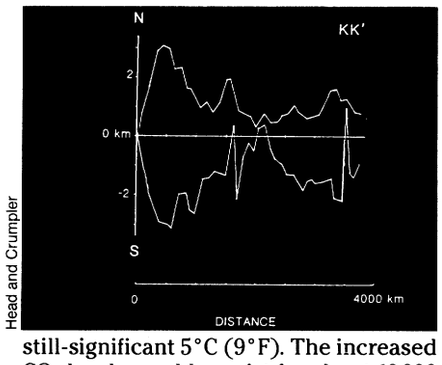
The last astronauts left the moon in 1972, and the United States has not even launched an automatic probe to another world since 1978. Yet the 19th Rockfest last week saw record numbers both of scientists in attendance (about 750, including American, Soviet, European and Japanese) and of scientific papers (678, whose three volumes of extended abstracts yielded a stack nearly 4 inches thick).

One major topic was the earth itself, as researchers continued efforts to piece together the numerous plant and animal species that have become extinct over the planet's history. A much-discussed hypothesis has been that the widespread mass extinctions may have resulted from lowered temperatures due to the blockage of sunlight by the dust of a major meteorite impact. More recently, researchers have suggested that higher temperatures — triggered by the death of certain light-reflecting ocean plankton following an impact — may have been the culprit (SN: 3/12/88, p.165).

Newly raised at the Rockfest, however, was an alternative suggestion, also involving heat, by John D. O'Keefe and Thomas J. Ahrens of Caltech in Pasadena. They suggest that a large impact into carbonate-rich sedimentary rock, such as is found in shallow seas but absent in the deepest places, could have released a great quantity of carbon dioxide into the atmosphere, trapping the sun's heat. O'Keefe and Ahrens base their conclusion on studies of impacts by projectiles into calcite (limestone) at speeds up to 13,500 miles per second, after which they measured the resultant release of carbon dioxide as a function of pressure. "If a comet with a radius of 50 kilometers struck the earth at a 4-kilometer-thick carbonate-rich layer," the authors conclude, "there would be an immediate hundred-fold increase in the amount of CO_2 in the atmosphere.

"This would lead to an increase in average temperatures of about 20°C (36°F) within only 10 days due to the greenhouse effect. . . .Even in the case of a smaller impact on a thinner carbonate layer — say, a meteor with a radius of 20 km landing on a 1-km-thick layer — worldwide temperatures would increase by a still-significant 5°C (9°F). The increased CO_2 levels would persist for about 10,000 years."





Head and Crumpler

Radar map of Aphrodite Terra on Venus (above) indicates possible "cross-strike discontinuities" reminiscent of details in earth's ever-evolving crustal plates. Similarities of contours at equal distances north and south of Aphrodite (left) suggest at least the possibility of what happens on earth at the ends of some growing plates.

Also being studied with earth in mind is Venus, where radar observations by U.S. and Soviet spacecraft have suggested what may be a dramatic range of tectonic processes. For example, radar maps of a vast, near-equatorial highland on Venus called Aphrodite Terra, which extends more than a third of the way around the planet, indicate what James W. Head, Lawrence S. Crumpler and other researchers at Brown University in Providence, R.I., describe as "cross-strike discontinuities," similar in appearance to the spreading rift zones between the plates of earth's crust.

Head and his colleagues do not assert that earth-style plate tectonics are taking place on Venus. "The point," says Head, "is to find out what's going on, not just whether it fits a terrestrial stereotype." But although they would like the radar maps to be sharper (the U.S. Magellan spacecraft, due to be launched to Venus next year from the space shuttle, should make a significant difference), there are already intriguing signs. If crustal plates on Venus are indeed being moved apart due to the emergence of new crust, comparison with the terrestrial example — "the only one we've got," notes Head — suggests that there might be signs of the thickening of the two plates' "outer ends," the portions farthest away from the "spreading center." The crustal plates of Venus may well follow a different set of rules, but diagrams Crumpler presented at the Rockfest at least seem to suggest symmetrical patterns at equal distances north and south of Aphrodite Terra.

Earth's moon, meanwhile, is not being left out of the picture. President Reagan's new space policy includes plans for a permanently inhabited base on the lunar surface. In addition, scientists and NASA planners alike are working to initiate a Lunar Geophysical Orbiter to conduct scientific studies of the moon years before such a base is even begun.

— J. Eberhart

Cajon Pass drilling: Down the tubes?

While other nations are pouring more money than ever into scientific drilling projects that reach deep into the earth's crust, researchers at the deepest scientific drillhole in the United States, located near the San Andreas fault, are packing up their instruments. They are preparing for next week, when funding cuts will force the end of drilling operations there for at least two years, if not permanently. Now at a depth of 3½ kilometers, the hole at Cajon Pass, Calif., is still some 1½ km shy of its original goal, and San Andreas experts are wondering if 3½ km is deep enough to resolve a 20-year-old paradox about the fault.

"The whole purpose of this experiment was to do something definitive, which meant going deep enough," says Stanford University's Mark Zoback, who is chief scientist on the Cajon Pass project.

Although the hole has provided some answers about the earthquake-producing forces along the San Andreas, the researchers have yet to reach the important depths between 5 and 10 km, where great California quakes are born.