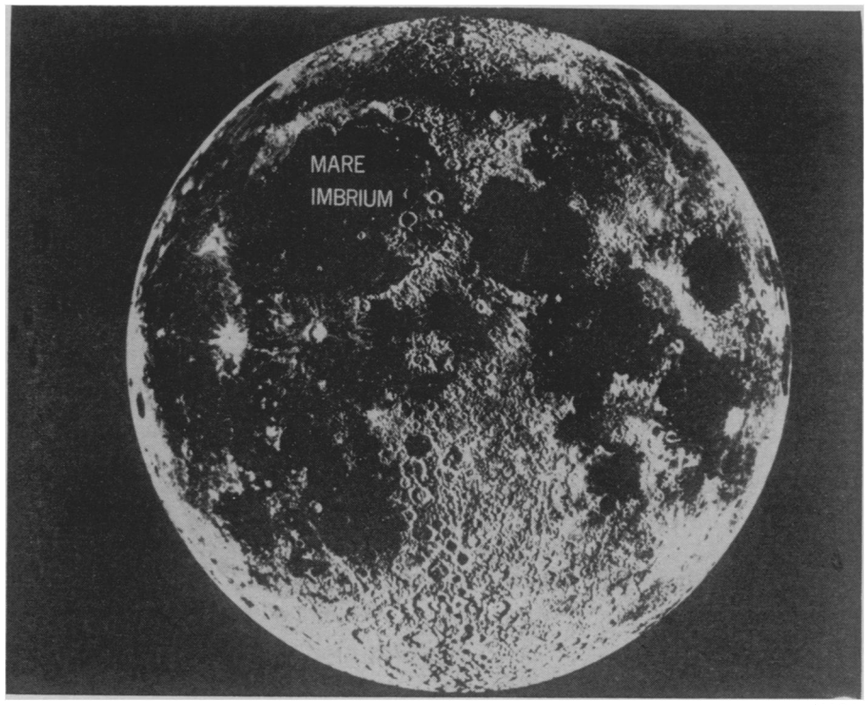
Imbrium basin: Not as old as it ought to be

Ages of the Apollo 14 samples cause rethinking about early history of moon, solar system



NASA

Age of 3.9 billion years is less than expected for origin of Imbrium basin.

So far only one rock found on the surface of the moon has been older than about 4 billion years (SN: 5/30/70, p. 528). The oldest rocks found anywhere in the solar system—pieces of meteorites—are 4.6 billion years old. The scientists who work with such things had hoped the Apollo 14 expedition would bring back rocks whose age would fall somewhere between those two figures. It didn't, and that's the big surprise.

Dr. G. J. Wasserburg of the California Institute of Technology, who reported on the work of the Apollo 14 rock daters at the 14th Plenary Meeting of the international Committee on Space Research (COSPAR) in Seattle last week, says this should lead to revisions of some pet theories regarding the history of the moon and the solar system.

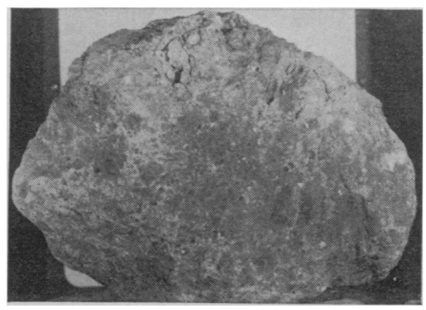
Apollo 14 was sent to the region north of the Fra Mauro crater in the hope of picking up rocks that would tell the age of the impact that dug-out the Imbrium area we now call Mare Imbrium. The Imbrium basin is several hundred kilometers across and if it was formed by an impact of the moon by some large body, the Fra Mauro region is one of the places where debris should have fallen. Some scientists had expected that Imbrium debris should be older than 4 billion years because they believe that objects large enough to produce large basins had been cleaned out of the solar system before that time. (Other scientists had argued, however, that since Imbrium appeared to be the youngest of the circular basins, a theory determined by crater-counting, Imbrium could very well be younger than 4 billion years old.)

The rocks brought back by Apollo 14 turn out to be between 3.8 and 3.9 billion years old. If they are Imbrium debris, their age means that the basin was formed less than 4 billion years ago. Dr. Wasserburg admits a possibility that they not be Imbrium debris but all evidence from studies of the mechanics of cratering insists that they should be.

According to the standard hypotheses of the history of the solar system, 4.6 billion years ago is the time the planets formed. At that time there was a lot of debris floating around the solar system in unstable orbits, and major lunar features are explained as a result of impacts from this debris.

The Imbrium basin was supposed to be a prime example. Pieces of debris would have collided with the moon as they drifted in toward the sun. All of this bombardment by large bodies was supposed to have ended before 4 billion years ago. The gravitational forces of the solar system are such that large bodies in unstable orbits should have been swept into the sun rather quickly. Those in stable orbits—orbits that keep them at a more or less fixed distance from the sun—would not strike the moon.

The first thing that the Apollo 14 results tend to show, says Dr. Wasserburg, is that bodies of several hundred kilometers in diameter were still flying around in unstable orbits much later in the history of the solar system than scientists had thought. It means, he says, that there must have been some way to store such bodies in stable orbits for a few hundred million to a billion or more years and then have them become unstable. Such a thing is possible because the gravitational balance of the solar system is a delicate one. Although the sun is the main influence, and the planetary orbits are mainly ellipses about it, the planets have a small perturbing influence on each other and it is possible for the perturbations to make an orbit become unstable after the passage of time.



NASA

One of the rocks found at Fra Mauro.

Additionally, says Dr. Wasserburg, "we must look at the terrestrial planets with an attitude very different from that of the past." They, too, Mercury, Venus, Mars and the earth, would have been taking a similar pasting at the same time. It may explain, he says, why the earth has no rocks older than 4 billion years. Continual plowing and melting would have made it impossible for them to survive.

The new evidence, says Dr. Wasserburg, also lessens the need to use volcanism from internal heat sources to explain part of the history of the moon. Scientists had believed that the large impact basins were formed more than 4 billion years ago. Yet samples

from the lava-flooded lowlands kept coming up with ages between 3 billion and 4 billion years. Therefore, some scientists concluded, the maria basins must first have been dug and then a billion years later, or so, volcanic activity spread lava over their floors. Dr. Wasserburg says this explanation is no longer necessary since the formation of the basins now seems to coincide with the ages of the material on their floors, and it seems plausible that impact heating could have formed molten and resolidified rock without any need for volcanism.

In general, says Dr. Wasserburg, the evidence tends to indicate that the moon is neither a fossil of the formation of the solar system that had been dead since the beginning, nor a body that has remained continually active geologically. Rather, he says, it has done the diabolical thing, and gone between, having been active for a long while and then stopped.

Current evidence still leaves a mystery about what was happening to the moon during its first 600 million years. Dr. Wasserburg hopes that samples from the lunar highlands may tell. Apollo 15 will go to Hadley Rille at the base of the Apennine Mountains, and one of the possibilities is that this expedition will bring back rocks from Apennine Mountain front. These could tell some of the story. Dr. Wasserburg guesses that they could be up to 4.2 billion years old. □

AMA CONVENTION

Decline of an American institution?

The 1971 annual convention of the American Medical Association held last week was, like its host city, an expensive facade that belied its actual value. Perhaps it was the less-than-scintillating allure of the Atlantic City boardwalk, the lack of activist demonstrators who took the 1970 AMA convention in Chicago by siege, the sharp drop in AMA membership (only 64 percent of American doctors now belong) and in AMA convention attendance. Some 8,000 physicians came to this and last year's conventions compared with a 16,000-doctor turnout at the New York City convention in 1969. True, some of this year's convention defectors skipped out to San Francisco for a meeting of the American Diabetes Association, which was inadvertently scheduled the same week.

All told the 1971 AMA convention lacked the razzmatazz of some of its predecessors. Papers were, to a large degree, rehashes of old-hat research; scientific exhibits and drug booths were considerably déjà-vu; and with drug samples at conventions now verboten, there were few giveaways beyond soft drinks and bars of soap. However, the convention was saved by one redeeming event: President Nixon touched down in Atlantic City on June 22 to address the AMA House of Delegates. It was the fourth time a President of the United States had addressed the House of Delegates at an AMA convention. Mr. Nixon appeared to be at home in this Establishment of all Establishments (average Delegate age is 59.4 years).

In his address to the house, the President came across with admirable pounce on two issues close to his heart—his desires to thwart an ever-encroaching national health insurance plan and to trump up the war against drug abuse. He asked the AMA doctors for their support. The reply came June 24, in full-page AMA ads in various American newspapers (part of a new AMA public relations campaign). "We accept, Mr. President," proclaimed the ads. "You challenged us to assume the leadership in a national campaign to shape this country's attitude toward drugs . . . to educate America to the serious dangers of drug abuse. We accept that challenge. . . . You challenged us to assume America's health care system . . . to design a system that will insure freedom of choice . . . dedication to quality . . . economic relief for our citizens and protection against catastrophe. We accept that challenge. . . ."

Yet ironically, while an outstanding number of resolutions introduced into the House of Delegates concerned physicians' crackdown on drug abuse in our pill-popping society, most of the resolutions, during a polemical drug-go-round, were shelved or passed in innocuous versions.

A proposal for forthright control of amphetamines (to prescribe no more than a two weeks' supply of amphetamines for mild depression or for starting diets, to prescribe them only for other well-recognized medical indications, to prescribe them only for patients known by a doctor) was not passed, primarily because the house decided medical ethics should be handled by the AMA Judicial Council, and the council did not introduce the resolution. Also, some Delegates felt the proposal would step on the physician's freedom to practice medicine as he sees it.

Nor was the resolution passed that the AMA urge the advertising and drug industry to eliminate all proprietary drug ads from radio and television. Supposedly Resolution 85—that the AMA lend its full support to plans of the Justice Department to set production quotas on amphetamines and to tighten their distribution—was adopted in lieu of the two previously mentioned proposals. Resolution 85, some AMA convention watchers feel, boiled down to buck-passing on drug abuse.

Similarly the suggestion to bring about banning of ads in mass media that promote the use of mood-changing and analgesic drugs was usurped by a milk-toast substitute resolution: to follow studies being conducted to ascertain the relationship between proprietary drug advertising in the mass media and excessive use of nonprescription drugs, to cooperate with the Federal Trade Commission to ensure enactment of proprietary drug ad regulations and to establish effective liaison with the National Association of Broadcasters and the Proprietary Association to ensure more stringent voluntary controls over proprietary drug advertising in mass media.

On a more cheerful note, the House of Delegates came to grips with some relevant issues. They concurred that the AMA should influence President Nixon to proceed with his proposed commission to study a soaring malpractice claim problem, and to assist the commission in its work. They voted to support continuing Government funding for basic and applied medical research, agreed that doctors should work at the 1971 White House Conference on the Aging, tackled the role of the physician's assistant and doctor-paramedical teamwork. They resolved to study potential problems, as well as advantages, of multiple health maintenance organizations. Such organizations, as being contemplated by Congress, would develop in a community or county with clinic, hospital, insurance company or union as its base.

When the House of Delegates comes to grips with issues, the spin off for American society can be considerable, or negligible—it depends. As one of the more powerful lobbying groups in Washington, the AMA can flex its muscles where Congressional legislation is involved. It can raise vibrations in the Health, Education and Welfare labyrinth. Other resolutions become official policy for AMA members, to be implemented by state or county medical socities or by physicians in their practices. However, house resolutions "referred for further study" or "filed" in AMA archives will probably have little impact on American society at large.

Whether the 1972 AMA convention, to be held in San Francisco, will be worth attending, even the most astute medical seer can't say at this time. An AMA spokesman indicated that the AMA is vaguely troubled with the direction its conventions are taking and means to look into the situation. □