three years. If the earliest IOC were achieved, the number of operational launchers might fall somewhere between 10 and 25 in 1975. In the more likely event that IOC is later, achievement of such a force would slip accordingly."

Which leads to the conclusion that the Chinese missile program is lagging. "The ICBM has slipped from what has been forecast," notes Dr. William W. Kaufmann of the Massachusetts Institute of Technology. "The original expectation was for at least a small operational capability for the early 70's for the ICBM. Now it's the mid to late 70's."

The cause of the lag is uncertain. One possibility is that since the Chinese have the theoretical knowledge—credited in large measure to Dr. Chien Hsueh-shen of the Massachusetts Institute of Technology, who was driven out of the United States in 1955—they must be short on engineering and logistical know-how. Another potential factor could have been Mao Tse-tung's aborted Cultural Revolution, which disrupted the country in general and the ministry responsible for missile development in particular.

It is also considered likely that the prestigious launching of a space satellite might have been a trade-off against the Chinese missile effort. "The space capability takes energy from the military impetus," points out Dr. Davies. "It takes the same aerospace industry to work on other components of the ICBM."

For that reason, he sees the launching as a political move on the part of the Chinese.

There is another possibility. The satellite may actually represent a new direction in the Chinese military program. Rather than going to conventional launchings from land based sites, the Chinese may be on their way to developing an orbiting satellite system to launch nuclear warheads.

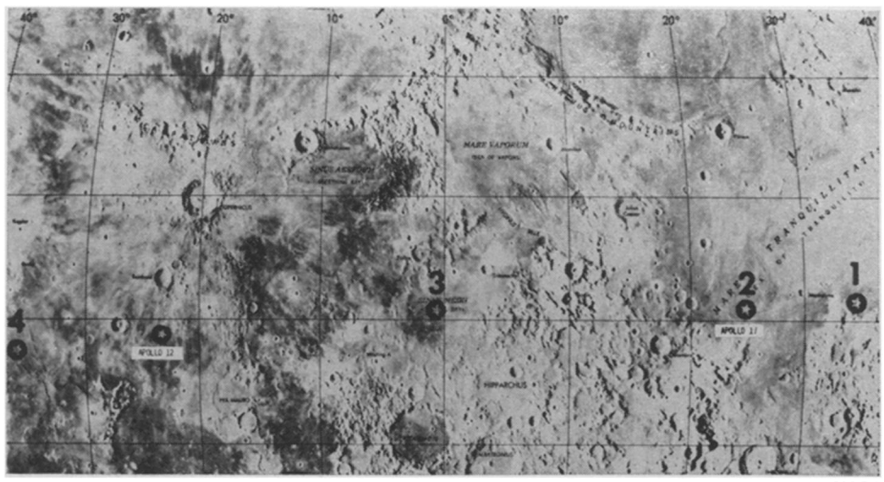
The suggestion comes from analysts in Hong Kong, who although they admittedly have little technical information to go on, base their thesis on China's ability to leapfrog, or bypass, intermediate technological stages and so gain ground. If so, such a system would be supplemented by a submarine missile fleet. But the capability for this is still down the line since present Chinese missile subs cannot fire from underwater.

But if the Chinese feat was political, a Soviet multiple launch on Saturday, one day later, had the earmarks of something far bigger.

Eight unmanned satellites were put into orbit from one rocket, and Heinz Kaminski, director of West Germany's Space Research Institute, infers from the positions of the eight that this could be a Soviet attempt to set up a space station. □

APOLLO 12 SURPRISE

Back to time one



NASA

Ages of the Apollo 11 and 12 sites differ by only a few hundred million years.

If there is a lesson in the Apollo rocks for investigators of the moon's history, perhaps it is that they should not become too firmly attached to any one conclusion; the findings may soon change.

This was brought home to scientists at the American Geophysical Union's annual meeting in Washington last week. The preliminary analysis of the rocks brought back from the Ocean of Storms by the Apollo 12 mission had tentatively dated them at 2.6 billion to 2.9 billion years old (SN: 12/20, p. 573), based on potassium-argon dating. This was nearly a billion years younger than the Apollo 11 rocks from Tranquility base and it set into motion a round of speculation.

The considerable difference between the times of crystallization of the rocks at the two sites seemed to imply that the events responsible for surface melting on the moon continued over a considerable period of the moon's history. It lessened the possibility that the moon's rocks were shaped during an intense and relatively brief interval of activism about 3.6 billion years ago, as many scientists felt was implied by the Apollo 11 samples.

Then last week at the AGU meeting Dr. Gerald J. Wasserburg of the California Institute of Technology, one of the principal lunar sample investigators, dropped his surprise. In strontium-rubidium analysis of two Apollo 12 rocks just completed at their Caltech laboratory, he and Dr. D. A. Papanastassiou and others had determined that the rocks were 3.4 billion years old.

The Apollo 12 site is thus almost the same age as the Apollo 11 site, not a billion years younger. The Caltech workers conclude that there was widespread outpouring of lavas over the mare regions, in a relatively narrow time interval of 200 million to 300 million years, about 3.5 billion years ago. "This must represent a major episode of physical and chemical differentiation of the moon," the Caltech group suggests.

The result is making lunar scientists wonder whether the other maria are the same age, and if so where the energy for such a major episode came from.

"If there are no younger rocks on the other mare sites," says Dr. Wasserburg, "we must attempt to understand what the precise mechanism is by which the thermal energies of the moon were shut down to prevent further volcanism."

Dr. Wasserburg believes the melting was due to buildup of internal heat from radioactive decay during the time after the moon was formed 4.6 billion years ago. The similarity in ages between the oldest rocks on earth and the Apollo samples, he suggests, may be due to a similar length of buildup of internal heat within the earth. In fact Dr. Wasserburg believes that most of the terrestrial planets underwent the same melting period.

Some other scientists feel that it is too early to attribute the lunar melting to internal heating rather than to impacts by an intense barrage of meteoroids sometime around 3.5 billion years ago. More definitive data should come from the forthcoming Apollo missions.

For now, the new age determination seems to have had the effect of wiping away smugness. Some geologists who had attempted to calculate the age of the Ocean of Storms by the number of impact craters visible had decided they could show good agreement with the preliminary dating of the Apollo 12

samples. Now their method is being called into question.

"In view of this latest data, these guys are really staying loose on their feet," says Dr. Louis S. Walter of the National Aeronautics and Space Administration's Goddard Space Flight Center and chairman of one of the AGU moon sessions. "No one wants to commit himself."

Nevertheless some new lunar origin theories are being advanced, if not wholeheartedly accepted.

Dr. A. G. W. Cameron of Yeshiva University proposes a complicated theory involving condensation of the moon, which is deficient in iron and volatile elements, from portions of a huge proto-earth atmosphere in orbit beyond three present earth radii. His analysis is different but his resulting model is essentially the same as that proposed earlier by Dr. A. E. Ringwood for formation of the earth-moon system (SN: 1/10, p. 34).

Dr. John A. O'Keefe of NASA, by contrast, points to evidence that the moon was formed by fission from the earth after it was formed.

"The point," says Dr. Walter, "is that it is just too early to be selecting theories of lunar origin based on the Apollo samples." □

LEG 10

Challenger in the Gulf

Some geologists have theorized that the Gulf of Mexico was shallow at one time and sank to its present depth sometime between 10 million and 100 million years ago.

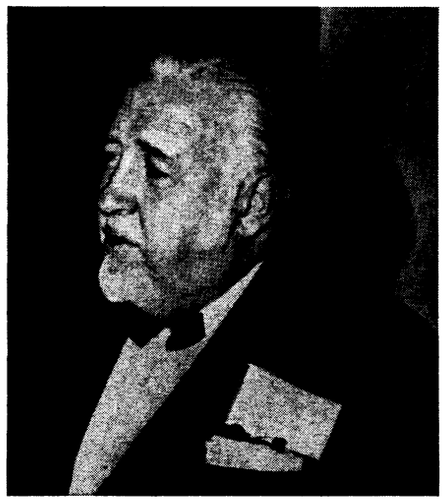
In Leg 10 of the Deep Sea Drilling Project, completed April 5, 13 holes were drilled as much as 2,900 feet into the Gulf floor. The cores, report co-chief scientists J. Lamar Worzel of the Lamont-Doherty Geological Observatory and William R. Bryant of Texas A&M University, establish that the Gulf of Mexico has been a deep-water basin for at least 65 million years and possibly for 100 million years. The drilling thus narrowed down considerably the time period during which the Gulf could have been formed.

The voyage also found deep deposits of thick, coarse sand, evidence of strong turbidity currents carrying vast amounts of sand to the deep basin 25 million years ago. Some scientists have believed such strong turbidity currents occurred only during the Pleistocene ice ages, a million or so years ago.

All holes drilled in the deep basin encountered natural gas, predominately methane. The voyage operated under severe restrictions on drilling in the northern Gulf floor, where the release of oil into the water was considered a possibility. □

FASEB MEETING

Breaking up a giant



FASEB

McManus: An interesting experiment.

The nation's biologists, some 22,000 strong, held their annual celebration of the rites of spring last month in Atlantic City. From across the country, they traveled east for the 54th meeting of the Federation of American Societies for Experimental Biology to hear about the latest advances in research in the life sciences. More than 8,000 of their number were co-authors of one of 3,300 papers chosen for presentation at the world's largest multidisciplinary gathering of biologists.

But increasing interest in smaller meetings focusing on highly specialized topics is leading to change. Next year, the biochemists, officially the American Society of Biological Chemists, will take a leave of absence from the FASEB convention, drawing about half of the federation's members to a June meeting in San Francisco instead of the traditional April meeting which will be in Chicago. Then, in 1972 and 1973 the separatist biochemists will rejoin FASEB in Atlantic City, only to split again in 1974 to hold their meeting jointly with the Biophysical Society in Denver. Thereafter, they will decide whether to make the split permanent.

The possibility of parting from the massive FASEB meeting, according to Dr. Robert Hart, executive director of the Biological Chemists, has been under discussion for several years. Ironically, the catalyst to the upcoming split in an essentially apolitical organization (FASEB rarely speaks with a single voice on political questions) was the political havoc that prevailed in Chicago at the 1968 Democratic Convention and the federation's choice of Chicago as its 1971 meeting site. In protest to the Chicago violence, the biochemists elected to boycott that city.

There are pros and cons to the move, and the outcome is unpredictable.

The federation is the administrative umbrella for six biological societies: the biochemists, the American Physiological Society, the American Society for Pharmacology and Experimental Therapeutics, the American Society for Experimental Pathology, the American Institute of Nutrition and the American Association of Immunologists. From its headquarters in Bethesda, Md., it handles the publication of journals in each specialty and runs the spring meeting which is virtually the only regular interdisciplinary convention in biology.

The massive FASEB gathering encompasses sessions on special problems such as the regulation of respiration, the physical chemistry of proteins, cardiovascular drugs and immunogenetics.

It sponsors special symposia, such as one this year on neurobiology, where only a few researchers speak about their work and map out future areas of investigation. And it brings the assembled researchers into contact with yet more generalized topics pertaining to their work.

Thus, in its scope and diversity, the FASEB meeting is a unique forum. Unlike the annual American Chemical Society meetings where chemists from various specialties gather but speak virtually only among themselves, significant numbers of biologists exploit the interdisciplinary offerings of FASEB, with physiologists attending papers on biochemistry and biochemists returning the interest. If the biochemists' departure is permanent, this quality will obviously be lost, especially for younger scientists who, in contrast to their department chairmen and mentors, do not cross the country from meeting to specialized meeting.

On the other hand, Dr. Hart points out, the biochemists were eager to break from FASEB's traditional Atlantic City-Chicago circuit, feeling that by holding their meetings in a variety of locations they will ultimately provide more young scientists, particularly those from the West, an opportunity to attend.

Dr. J. F. A. McManus, executive director of the federated societies, calls the biochemists' departure from the fold an "interesting experiment" in meeting protocol, and stresses that it reflects a reaction to the growing size of the FASEB meeting rather than a philosophical schism.

There is, he says, a growing interest in holding smaller meetings, evidenced by the fact that the pharmacologists and physiologists now hold specialized fall meetings in addition to participating in the spring FASEB convention. The nutritionists are considering a similar action. Whether the biochemists will ultimately choose the same course remains to be seen. □