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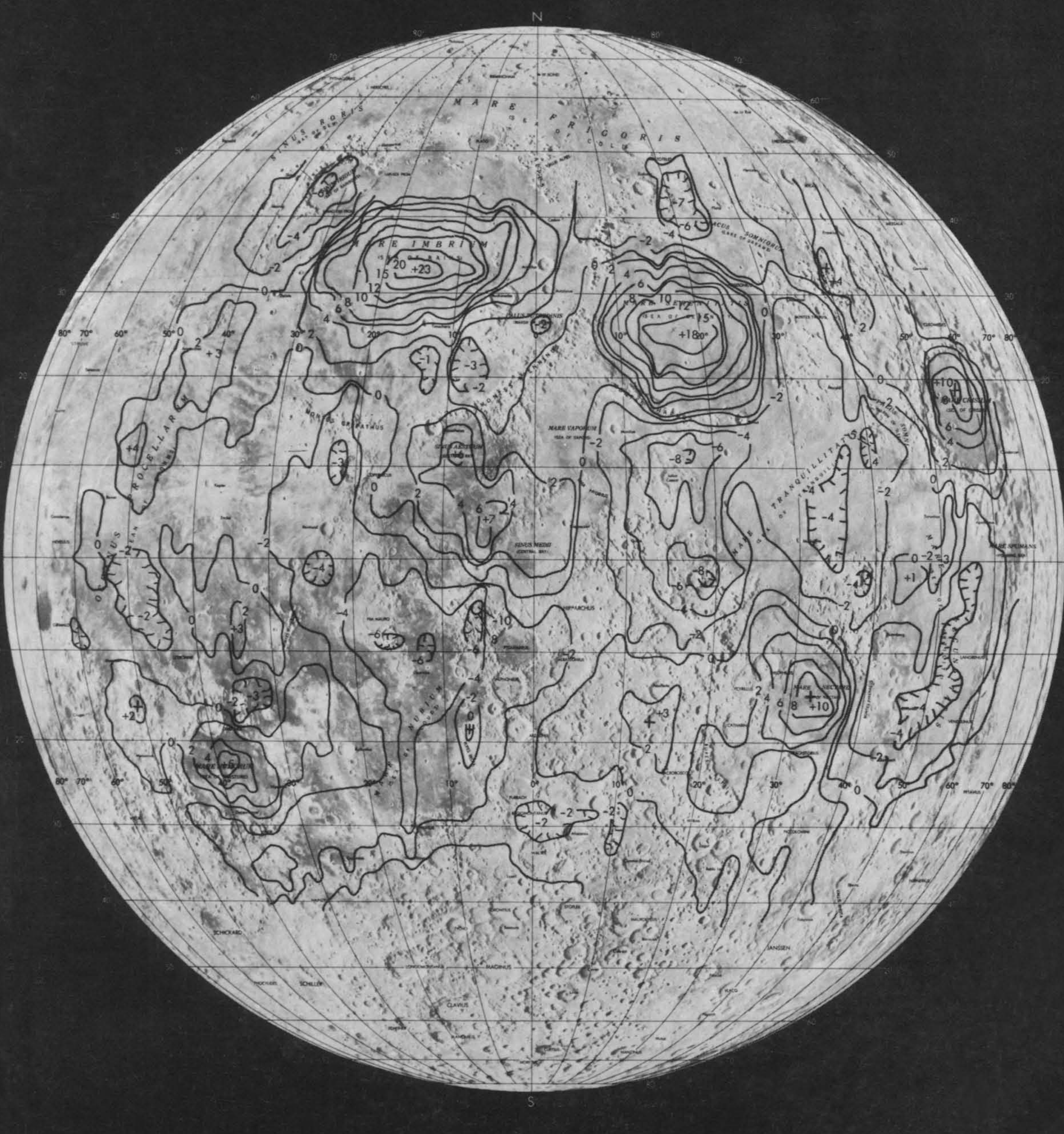

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COVER

Lunar gravimetric map of the earth-side hemisphere obtained from Lunar Orbiter spacecraft tracking data. The newly discovered dense mass concentrations (mascons) under each of the ringed seas (maria) are shown. The units are keyed with the table under Fig. 1, page 681. [The topographic map is a standard ACIC lunar map. The overlay is from Jet Propulsion Laboratory, California Institute of Technology, Pasadena]

Toxicity of New Drugs

My letter of 8 July 1966 expressed concern as to whether pharmaceutical manufacturers investigating new drugs were reporting toxicity findings to the Food and Drug Administration. As a drug investigator, I became aware of this problem when I learned that the toxicity data of our Dornwal study for Wallace and Tiernan in 1961 had not been reported to the FDA. The suppression of information about this tranquilizer led a federal district court to impose a maximum $40,000 fine on the company and place its medical director on probation for 1 year.

I reviewed reports of 26 new drug studies made between 1954 and 1966 and asked the FDA if the reports about safety had ever been received from the pharmaceutical companies as required by the the New Drug Section of the Pure Food and Drug Law of 1938. This law, which is the result of the 100 deaths of the 1937 sulfanilimide disaster, requires a manufacturer to test each new drug for safety and submit the data to the government before the drug can be marketed. My concern was confirmed when I learned that the FDA had received only 10 of 26 reports on drug safety which had been submitted to 19 pharmaceutical manufacturers. The 14 companies which failed to submit toxicity reports included some of the largest and most scientifically capable pharmaceutical houses.

I recommend that Congress require each investigator of new drugs to send a copy of his entire report to the FDA and other government agencies concerned with drug safety and efficacy. Also the law should require that each new drug investigator be provided with reports of all other investigators who are studying the same or similar compounds. New drug research demands full exchange of information among the responsible scientists. Maximum safety demands informed collaboration between the investigator, the federal government, and the pharmaceutical manufacturer. The Senate Subcommittee on Antitrust and Monopoly headed by Senator Philip A. Hart of Michigan is currently studying changes in the laws governing drug research. Drug investigators should express their views to this subcommittee.

PAUL LOWINGER

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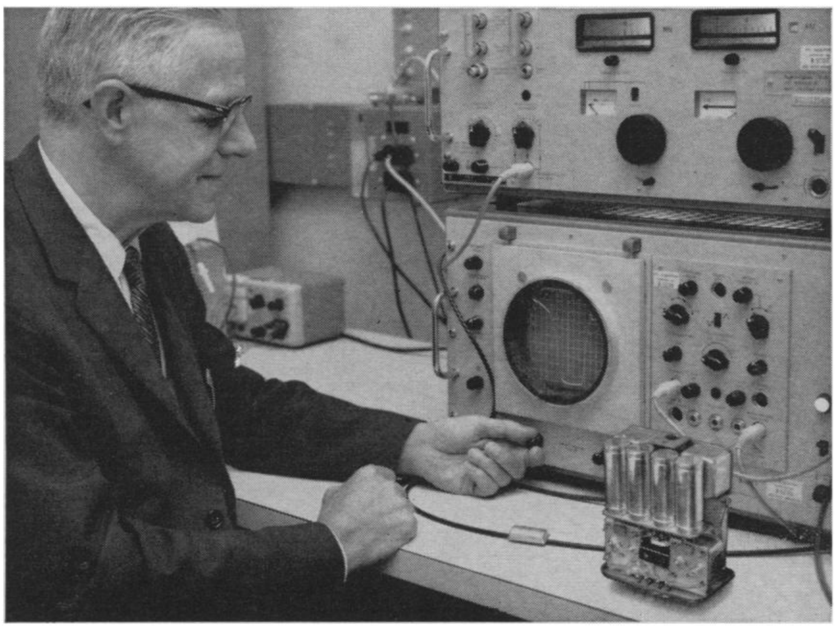
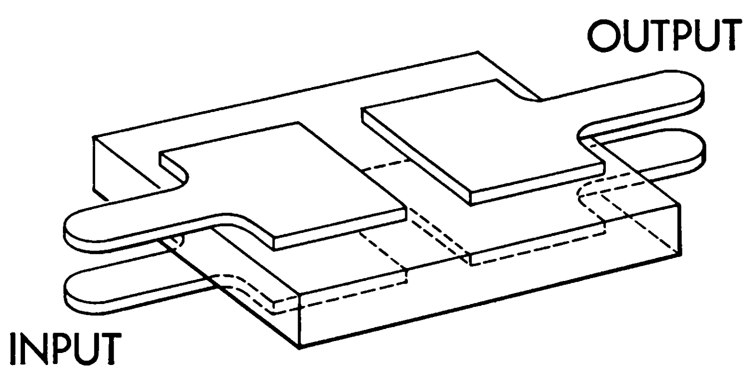
Report from

BELL LABORATORIES

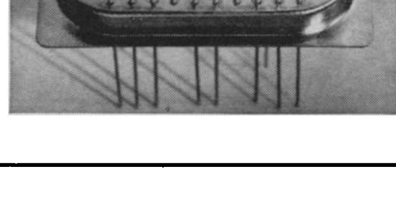
A Monolithic Filter



Roger A. Sykes, who directed the development program, checking the transmission characteristics of an eight-section 10-MHz monolithic filter (the tiny unit directly under the scope face). This unit replaces the larger filter seen to the right on the bench. Half-power points are 3.2 kHz apart.



Simple monolithic filter. Input and output resonators are formed by evaporating metal areas into opposite faces of a quartz plate. The resonators are coupled through the intervening quartz. Below, in actual size, is an eight-resonator monolithic quartz filter.



Electrical filters are widely used in communications systems to perform the important basic function of selecting, rejecting, and discriminating among various bands of frequencies.

Today's filters, depending on the design, might require a dozen or more components, including several quartz crystals. But now, as a result of work at the Allentown, Pa., location of Bell Telephone Laboratories, it is possible to design a quartz filter as a single, "monolithic" device.

The new filter is based on the fact that vibrational energy can be confined or "trapped" by pairs of metal-plated areas on opposite sides of a plate of crystalline quartz. The region within the crystal bounded by these areas thus becomes a localized resonator. A small amount of energy extends beyond this local region, however, and this energy can couple elastically to other resonators placed on the same piece of quartz. By choosing a suitable number of resonators and by spacing them properly, one can change the bandwidth of the filter and shape its in- and out-of-band characteristics.

The drawing (left) shows the simplest case—an input resonator and an output resonator coupled through the quartz plate. This would filter out all but a very narrow band of frequencies. The photograph (bottom) shows an eight-section filter designed to transmit a wider band of frequencies, with strong attenuation outside the band.

Monolithic filters are smaller and less expensive than earlier designs. Several types, in the 6-MHz to 20-MHz range, are now being produced for coaxial communications systems by the Western Electric Company in Merrimack Valley, Mass.

Bell Telephone Laboratories
Research and Development Unit of the Bell System

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Toward Better Vocational Education

For a favored sixth of the youth of this country, the educational system represents a pleasant pathway to a successful career. The remaining five-sixths are not so fortunate, and many find that their training has prepared them for nothing. Today skilled labor is in short supply. It is often necessary to wait weeks for services such as automobile repairs. Nevertheless, many young people are unemployed, including one out of every four nonwhite teen-agers.

As a nation we have been preoccupied with fostering excellence of a limited group while neglecting the overwhelming majority of our youth. One measure is federal expenditures. During the last fiscal year the government provided $4.5 billion for higher education and only $256 million for vocational education. Moreover, there have been many curriculum reform efforts benefiting college-bound students while vocational curricula have been little improved. One of our greatest mistakes has been to accord special prestige to a college degree while displaying indifference toward quality in craftsmanship. We reward verbal skill and abstract reasoning and deny dignity to manual workers.

A major source of many of our present domestic problems is that the educational system has not kept pace with the social changes around it. Much of the curriculum is admirably designed for the horse-and-buggy era. Today less than 5 percent of employment is on the farm. The big component of the labor force (about 45 percent) is white-collar workers. Among the blue-collar workers (about 37 percent), only about a tenth are employed as common laborers. In our society there is little place for the man or woman who has no special skill. If our increasingly technological society is not to deteriorate, we must find means of helping the young find useful roles whatever their particular aptitudes.

Under President Kennedy, a beginning was made in meeting this challenge with the passage of the Vocational Education Act of 1963. Among its many provisions was a mandate for periodic review by an Advisory Council on Vocational Education. The Council, under the chairmanship of Martin W. Essex, rendered its report* in December 1967, and many of its recommendations are being enacted into law.

Bills (H.R. 18366 and S. 3077) have passed the House of Representatives and the Senate unanimously, and a compromise conference version will be enacted. The bills authorize substantially increased funds for vocational education. The legislation attempts to correct deficiencies in both the federal and state administration of programs in vocational education. One mechanism is to earmark funds for such items as post-secondary training, training of groups with special needs, and exemplary and innovative projects.

The new legislation authorizes grants to colleges, universities, and other institutions for research and training programs. Support for development and dissemination of vocational educational curriculum materials is endorsed. The bills also give new emphasis to cooperative educational programs involving alternate periods of study and on-the-job training, and to residential vocational schools that would make it more feasible for disadvantaged youths to benefit from occupational training.

The new legislation will constitute a substantial step. However, the problem of preparing youth for the 21st century is now only being addressed. There is much need for involvement by many who have previously been oblivious to a great educational need.—PHILIP H. ABELSON

* Advisory Council on Education, U.S. Department of Health, Education, and Welfare, "Vocational Education: The Bridge Between Man and His Work"; published in condensed form as *Notes and Working Papers Concerning the Administration of Programs Authorized under Vocational Education Act of 1963* (Government Printing Office, Washington, D.C., 1968).

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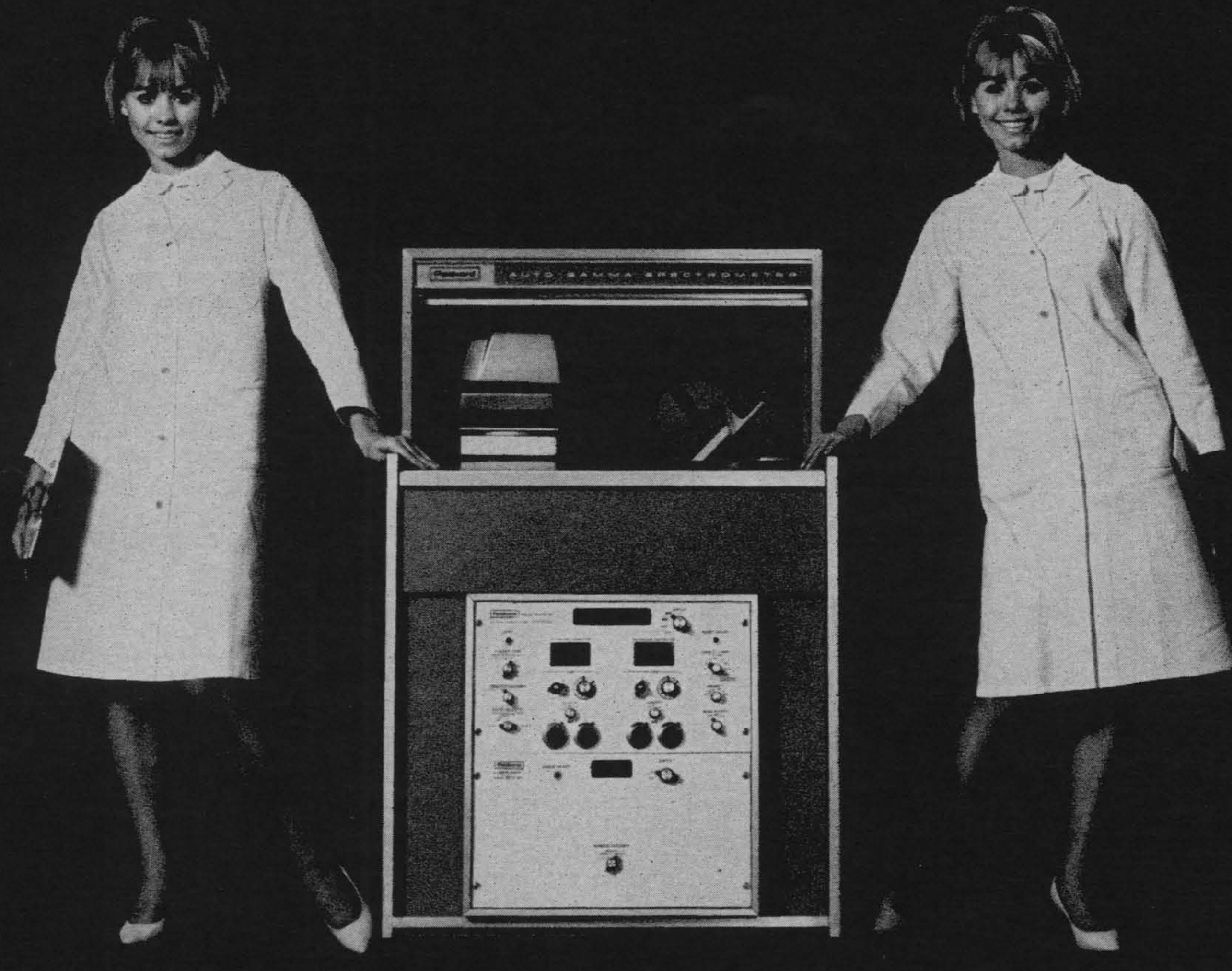

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H. D. Holland (Princeton) proposed that reactions of the type chlorite + calcite + CO_2 = dolomite + kaolinite + quartz + water have exerted a considerable buffering effect on atmospheric CO_2 during much of geologic time. But he suggested that before the evolution of land plants the CO_2 content of the atmosphere was approximately 10 times greater than at present, and that the *p*H of ocean water was approximately one half of a *p*H unit lower. W. T. Holser (Chevron Oil Field Research Co.), after noting the deficiency of salt and gypsum deposits in the Precambrian, pointed out the difference between the ratios of S^{32} to S^{34} of late Precambrian evaporites and organic shales as evidence of activity of sulfate-reducing bacteria at that time. He presented the secular variation of ratios of S^{32} to S^{34} in evaporites, showing pronounced variations that he attributed to non-steady withdrawal and supply of isotopically light sulfides with respect to the oceanic reservoir. L. G. Sillén (Swedish Royal Institute of Technology) proposed an equilibrium model for the oceans based on free exchange between atmosphere, ocean and crust, and dominance of silicate equilibria in controlling oceanic *p*H and atmospheric CO_2. He used the nine-component system CO_2-H_2-O-CaO-MgO-Al_2O_3-K_2O-Na_2O-HCl-SiO_2 to present probable phase relations and emphasized equilibrium models as the most important first approximation of this complex system. P. K. Weyl (State University of New York, Stony Brook) hypothesized an oceanic density gradient layer (thermocline) at a depth near 100 meters in which life may have originated and evolved. This layer would have been protected from ultraviolet radiation fed by convective cells from the sea surface and the low rate of diffusion in the layer would have led to an early accumulation of free oxygen. G. Nicholls (University of Manchester, United Kingdom) sought to infer evolutionary changes in the composition of seawater by following a chain of calculations from terrestrial abundances of trace elements to the abundance of sodium in Precambrian sediments, which seem to be richer in sodium than later rocks. He explained the richness of nitrogen as the result of lack of chemical "winnowing" during sedimentation in the early Precambrian.

The last morning was devoted to questions related to the origin of life. C. Ponnamperuma (NASA Research Center, Ames, California) described a scheme for synthesis of organic compounds from H, C, N, and O; reviewed energy sources, ultraviolet being by far the most important; and attempted to develop criteria for biogenic origin of organic compounds. J. Oró (University of Houston) discussed the evolution of self-replicating proto-DNA and similar molecules from primitive organic compounds in the early Precambrian. He argued for the need for estimates of maximum and minimum permissible concentrations of necessary building materials, such as sulfur and phosphorus. L. Margulis (Boston University) distinguished between evolution of procaryotic and eucaryotic cells and emphasized the importance of free oxygen in the atmosphere as a precondition for the evolution of eucaryotic organisms, which probably took place later in the Precambrian. A. R. Palmer (State University of New York, Stony Brook) summarized worldwide distribution of Early Cambrian faunas and concluded that shelled representatives of the major phyla and of many minor groups within the phyla all appeared within about 5 million years, but significantly later than the first records of metazoans without shells.

Discussion of papers was spirited and it appeared that there was no general agreement on the types of models to be used for the evolution of the earth's crust or for the evolution of the oceans or atmospheres. Equilibrium models vied with complex feedback mechanisms for support. The rock record was invoked to support many models but our current ways of looking at it seem not to provoke convergence to a unique solution. There was more general agreement that much of the Precambrian rock record showed no great differences from later rock sections in gross aspect. It seems that the general earth surface system, including the presence of primitive life, was established by 3.5 billion years ago, leaving only the first billion years of the earth's history for many significant events to have taken place. In the absence of any rock record of that first billion years, it may be that organic chemical investigations of the first steps in the formation of prebiogenic compounds and then the evolution of the first cell will prove to be the best guides to the nature of the physical and chemical environment of the earliest stage of earth history.

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