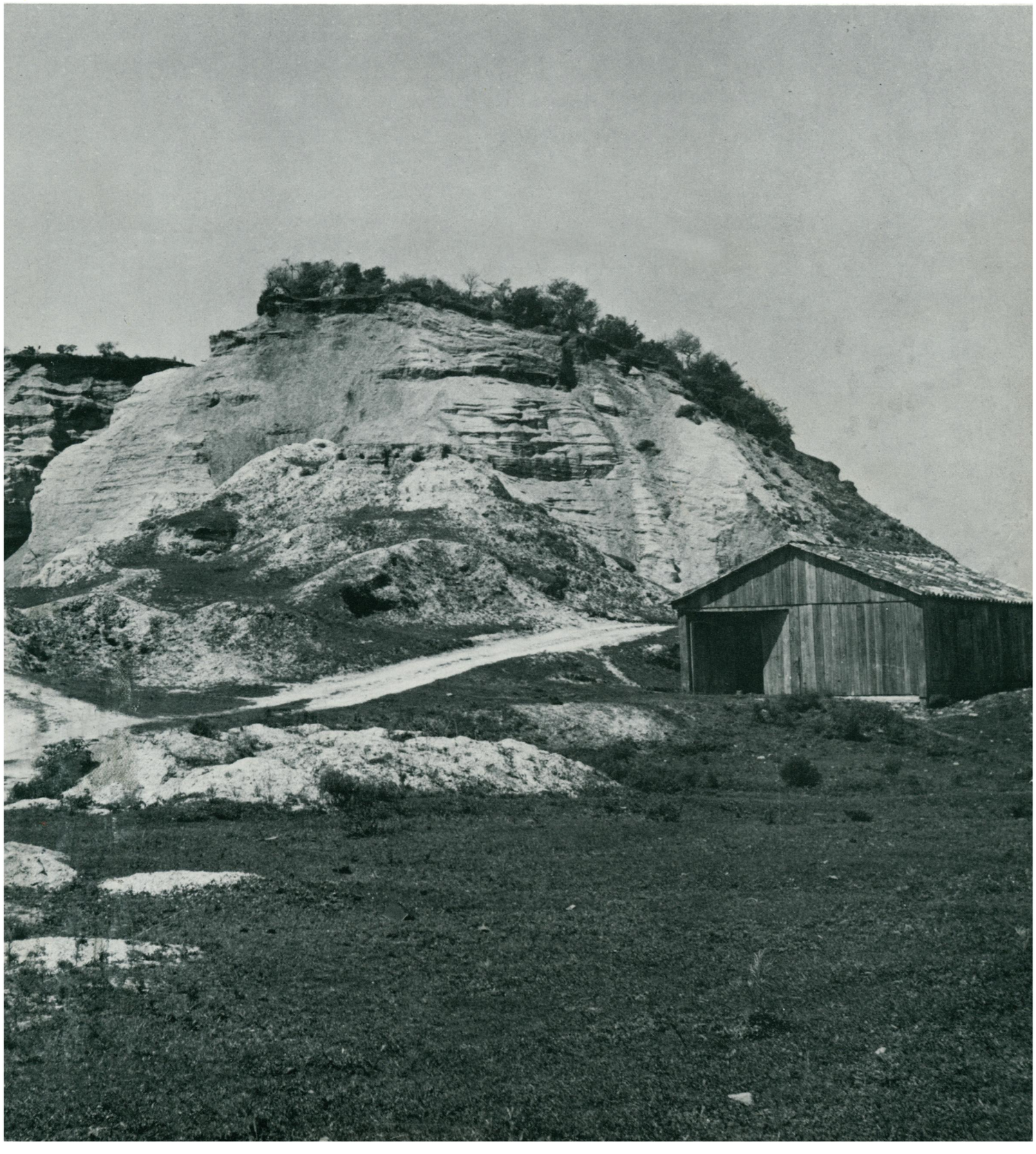
SCIENCE

30 January 1976

Volume 191, No. 4225

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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Volume 191, No. 4225

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COVER

A typical early Indian midden (20 meters in height) at Carniça, near Laguna, Santa Catarina, Brazil. The midden is in the process of being quarried for agricultural lime. See page 353. [Wesley Hurt, Indiana University Museum, Bloomington, Indiana]

LETTERS

MIT Methanol Project

The article by Allen L. Hammond (News and Comment, 21 Nov. 1975, p. 761) states that the circumstances surrounding the termination of a fleet testing project on methanol at the Massachusetts Institute of Technology's Energy Laboratory were ambiguous, perhaps suspicious, because of our receipt of substantial funds from Exxon and the Ford Motor Company and because an Exxon employee (on leave, and at MIT as a visiting professor) was involved.

We at MIT unequivocably reject this and point out that Ford, Exxon, and the employee in question have no corporate or personal stand against the use of methanol. The crux of the question was whether the money would be used wisely.

Hammond's article is apt to lead—and in some instances has led—the casual reader to suspect that industry opposes methanol, that the use of methanol is in the best interests of the United States, and that hence something suspicious is indeed afoot. This we categorically reject and suggest that *Science* should uncover all the facts regarding methanol as a gasoline additive before giving such important publicity to the case of a disgruntled researcher.

DAVID C. WHITE

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In Allen L. Hammond's article, "Methanol at MIT: Industry influence charged in project cancellation," my role in the development of methanol combustion research programs is represented as being predominantly negative. Since this is not the case, I would like to present my views on the potential of methanol as a fuel.

Methanol's outstanding combustion characteristics (no soot, efficient combustion over a wide range of fuel/air ratios, and high octane number) have been known for many years. When it became apparent that coal would become a major source of liquid fuels in the foreseeable future, I became involved in an assessment of the cost of producing fuels from coal by several methods (*1*). On a basis of cost per Btu, it appears that gasoline, Fischer-Tropsch liquids, and methanol produced from coal, while more expensive than current petroleum-based fuels, would be competitive with each other. The opportunity will therefore exist to exploit methanol's outstanding combustion characteristics when coal becomes a competitive liquid fuel source. Any of the coal-to-liquid fuel conversion processes, however, require a very large investment and construction effort, and it is expected that major production for fuels will be accomplished before 10 to 15 years from now.

When methanol becomes available for use as a fuel, the first application might well be in existing peak power gas turbine installations when reduction of nitric oxide emissions is required, since substitution of methanol can result in a dramatic decrease (by a factor of 2 to 5) with minimum system modification.

The most spectacular gains, however, might well result from the use of methanol-water blends in automotive engines, where the superior lean combustion characteristics allow efficient operation with extremely low NO_x emissions, and the high octane number allows use of high compression ratios (*2*). Use of water allows low NO_x operation at high power densities. Understanding of combustion under these conditions and optimization of an automotive system for its use are, in my opinion, high priority research subjects.

Use of methanol blends in gasoline is technically feasible; however, it doesn't take full advantage of methanol's outstanding combustion characteristics and would, in my opinion, be a lower priority use than the above two.

Use of methanol is not limited by finding ways to use it so much as by economics and the timing for construction of production facilities. Fleet testing is most valuable as a last step in an application program and should be performed on an up-to-date car population to be relevant. In the meantime, there is a great deal of research and system optimization to be done.

J. P. LONGWELL

940 Kimball Avenue,
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1. F. H. Kant, R. P. Cahn, A. R. Cunningham, M. H. Farmer, W. Herbst, E. H. Manny, *Feasibility Study of Alternative Fuels for Automotive Transportation* (Publication 235 582, National Technical Information Service, Springfield, Va., 1974).
2. W. J. Most and J. P. Longwell, "Single-cylinder engine evaluation of methanol-improved energy economy and reduced NO_x" (Preprint No. 750119, Society of Automotive Engineers, New York, 1975).

I feel obliged in my capacity as head of the Ford Motor Company's research staff and a member of the MIT Energy Laboratory Advisory Board to convey my chagrin over implications in the article by Allen L. Hammond concerning an MIT methanol project.

In commenting on the cancellation of a research project in which the use of methanol as a substitute for gasoline was being investigated at MIT's Energy Laboratory, Hammond cites the opinion of Thomas B. Reed, who initiated and led

the project, that "it was killed because the laboratory yielded to influence from the oil and automobile industries." After noting that the energy lab had been the recipient of two unrestricted grants from the Ford Motor Company Fund and from Exxon, Hammond states that "In addition, the laboratory's advisory board includes 7 oil and automobile industry people among its 24 members." He also addresses the question of "whether the energy lab's industry money and contacts have made it susceptible to influence." He concludes by noting that the "incident is troublesome because it raises the specter of universities adjusting their perspective as to what is important and their research programs to mesh more smoothly with government and industry."

These are serious charges that should not be casually accepted. Although Hammond does not comment directly on any Ford involvement, he notes that the grants received from Exxon and Ford "put the termination in an ambiguous, and perhaps suspicious, light." He does not mention that he talked with me by phone about these matters and that I assured him that I personally knew nothing of the energy lab's decision nor, to the best of my knowledge, had anyone else at Ford expressed any opinion to them about the fleet test, much less sought its cancellation.

I also provided Hammond with information about the extensive research on methanol-gasoline blends, pure methanol, and dual-fuel concepts of methanol and gasoline that has been conducted by the joint petroleum and automobile company Inter-Industry Emission Control Program, of which Ford is manager, and independently by Ford (*1*). While I noted that disadvantages exist with each of these systems, I told Hammond that I saw no unsolvable technical problems with them. Contrary to the view expressed by Reed, I believe the principal issue is economic, not political. Methanol will find a use as a fuel when the economics dictate it.

Hammond's article raises issues that go far beyond my own concern about the misleading implications and omissions I have mentioned, for it questions the propriety of industrial involvement in the academic world. Must universities be branded as handmaidens of industry when they seek and receive its financial support and know-how? Should the integrity of an eminent professor such as John Heywood be automatically questioned because he receives supplemental research support from industry? Is government support inherently more desirable than industry support? Are there to be no honest differences of opinion on technological and economic issues between the academic and industrial worlds? What is the proper relationship of the university and industrial communities?

I believe these issues transcend the current controversy over the methanol experiment at MIT. They are issues that must be resolved if the university and industrial communities are to work together more effectively. I strongly urge *Science* to pursue these important issues more thoroughly—and fairly—than appears to have been the case in Hammond's article.

W. DALE COMPTON

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20000 Rotunda Drive,
Dearborn, Michigan 48121

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1. A. W. Crowley, J. P. Kubrick, M. Roberts, W. J. Koehl, W. L. Wascher, W. T. Watrung, in *Inter-Industry Emission Control Program-2 (IIEC-2), Progress Report No. 1* (Special Publication No. SP 395, Society of Automotive Engineers, New York, 1975), reprint No. 750419; J. A. Harrington and R. M. Pilot, in *ibid.*, reprint No. 750420; J. A. Harrington, in *Symposium on Future Automotive Fuels* (General Motors Research, Warren, Mich., in press).

There are obviously two points of view regarding the MIT Energy Laboratory's sensitivity to potential conflicts of interest and independence of judgment, both reflected in the article. White does not contest the facts. But it is worth pointing out that the subject of the article was the way in which the energy lab handled its industrial relationships, rather than the propriety of industrial involvement in the academic world or the scope of industrial methanol research. It is also relevant that representatives of oil and automobile companies have testified against the use of methanol-gasoline blends at federal and state legislative hearings.

—ALLEN L. HAMMOND

Gas Chromatographs: Health Effects

In response to inquiries about the potential health effects of using gas chromatographs insulated with asbestos, we have examined by light microscopy oven insulation from several gas chromatographs manufactured by five companies. Two instruments contained asbestos, either chrysotile or amosite, as woven tape or in block form. The remaining three brands of instruments were insulated with fibrous glass or rock wool. The asbestos block is compacted, but it is not sealed, so that dust can be generated from the surface. After temperature-programmed operations, when the oven lid shuts forcefully, or during maintenance and repair procedures, visible amounts of dust can be produced from these materials.

30 January 1976, Volume 191, Number 4225 SCIENCE

Science in the Public Forum: Keeping It Honest

The debate on most matters at the intersection of science and society is largely conducted in the public, not the scientific, forum. When scientists express opinions on scientific matters in the public forum they are not subject to the sanctions that regulate opinions expressed in the usual channels of scientific communication. Because these traditional sanctions do not operate, the extrascientific debate often tends to be irresponsible scientifically: lower standards of proof are demanded in the public than in the professional debate, and half-truths are too often perpetrated on the public by scientists.

This tendency seems to me to be increasing. For example, in a recent article in a magazine devoted to science and public policy a physicist implied that nuclear weapons might detonate the atmosphere—when, in fact, this was shown to be a nonproblem some 25 years ago. Or consider the current debate on nuclear power. Two petitions, one pronuclear and the other antinuclear, were signed by scientists. Presumably, in signing the petitions, the scientists were implying that they possessed sufficient technical knowledge to make judgments on nuclear power. How many of the signers of either petition had studied nuclear power sufficiently to have a responsible scientific opinion on this complex issue?

A plea for greater responsibility on the part of scientists when they engage in scientific debate in the public forum poses serious practical, even epistemological questions. How can one know, when two scientists disagree on a scientific matter, whether it is because the issue is really beyond the proficiency of science or because one scientist has investigated the matter more thoroughly than the other? Some scientific issues can be unequivocally answered by science; others, perhaps most that are at the junction between science and policy, cannot—either because science has not progressed sufficiently (as in the debate on depletion of the ozone layer) or because the issues are unanswerable *in principle* (as may be the case with respect to long-term prediction of climatic changes). It seems to me that the scientist must be beyond reproach in doing his homework thoroughly whenever he makes scientific judgments, and he must delineate as sharply as possible where science ends and what I call trans-science begins. If this makes for fewer one-armed scientists and more scientists who say "I don't know," this is a hardship that Senator Muskie (who seeks more scientists willing to speak with certainty) simply must accept.

It is sometimes suggested that when scientists participate in nonscientific debates in which they claim special expertise, their obligation to speak responsibly is no greater or lesser than that of a lawyer or a politician. But science *is* special because, unlike law or politics, it deals with verifiable knowledge. Scientific methods of arriving at the best approximations to truth are known and tested. If scientists allow themselves the right to speak sloppily on science in the public forum, I think that this habit could gradually encroach upon the scientific forum.

Can we imagine mechanisms for injecting more responsibility into the scientific debate when it is conducted outside the scientific forum? Several suggestions have been made. For example, Arthur Kantrowitz has proposed a quasi-judicial scientific body that would conduct inquiries into conflicting scientific claims. The Operations Research Society of America, a few years ago, established a special panel to investigate contradictory technical assertions made by scientists in the debate on deployment of antiballistic missiles. Committees on ethics now exist within many professional societies. Should similar committees be set up by scientific societies?

The AAAS is a natural focus for these concerns. I would hope that the officers and members of the AAAS could exchange ideas on how to make the scientific debate in the public forum more responsible. Out of such an exchange might come better mechanisms for keeping our science honest, even when it is not subject to the usual sanctions of the scientific community.—ALVIN M. WEINBERG, *Director, Institute for Energy Analysis, Post Office Box 117, Oak Ridge, Tennessee 37830*

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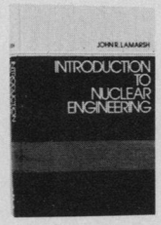

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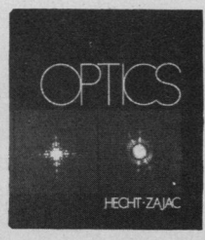

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