man silo with a single SS-9, the pressure to deploy Safeguard through this argument continues.

The debate that has resulted from the President's decision to deploy Safeguard has been widely publicized; the weakness of Safeguard is discussed so extensively in York's book that I do not wish to comment on it here in detail. I would like to summarize the situation through a graph which clearly documents much of what York is talking about in his book. At any given moment when a strategic decision is made only a very limited amount of information is available from which to project into the future. Yet the consequence of such decisions can only protect against a certain band of threats. The actual Soviet moves may go slower or faster than has been forecast by intelligence estimates; there is ample historical precedent for error in either direction. Therefore a good strategic decision should cover a relatively broad spectrum of anticipated Soviet moves; a bad decision would cover only a narrow range of threats at very large cost. The Safeguard ABM system is in this latter category.

The graph shows how the number of potentially lethal attackers against Minuteman might be growing in time. At present, there are 200-plus potential attackers in the Soviet inventory—very much below the amount which would constitute a real danger to Minuteman's remaining intact as a deterrent retaliatory force. If the present rate of growth should continue without any new technology there would be no problem until the end of this decade. If, on the other hand, MIRV's were to be adapted to Soviet SS-9's, or if existing Soviet missiles were to be greatly upgraded in accuracy, then such a threat could technically arise much earlier. However, the Soviets may equally well decide that they have now achieved approximate parity in land-based missiles and that they need not continue the rate of growth that has characterized the last few years. Of course, the present SALT talks may also inhibit further missile expansion.

If one looks at the situation honestly and is not trapped into accepting specific models of Soviet growth too literally, it is apparent that there is a large range of patterns by which the Soviet threat might expand. In the graph presented here I plot several alternative ways in which the threat might grow, and also show how very narrow is the band over which Safeguard can make any difference at all to the threat. This means that a decision like the Safeguard decision can in fact be escalatory because it raises doubts as to our intention, even though Safeguard either might not be needed at all or else could be defeated very easily. It would be something of a miracle if our opponents would happen to select a level of threat that exactly matched the level of defense we are providing against it.

A review of this kind cannot do justice to the thoroughly interesting detail, much of it of a personal nature, in which York conveys the flavor of the problems faced in military decision-making and describes the attitudes of the individuals concerned. His narrative leaves a convincing impression of the essential arbitrariness of the decision-making. As an example, the fact that the United States has 1000 Minutemen in the force today, rather than a somewhat smaller or larger number, is a consequence of the decimal system and of little else. No very profound deliberations were involved, yet it is the defense and survivability of these 1000 missiles which now occupy much of current strategic planning.

York comes to the conclusion—which is now hopefully shared by an ever-increasing number of concerned individuals both inside and outside the military establishment—that the only way to arrest the "race to oblivion" is through mutually agreed limitation and reduction of nuclear armament. The world hopes that SALT will be an effective step in this direction.

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British Prehistory

Lower Palaeolithic Archaeology in Britain. As Represented by the Thames Valley. JOHN WYMER. Humanities Press, New York, 1968. x, 430 pp. + plates. $22.50.

John Wymer has produced a valuable survey of Lower Paleolithic occurrences from the major part of the Thames drainage. The book combines a catalog-gazeteer of lithic implements and the sites that yielded them with an interpretative synthesis relating the sites and finds to Middle and Upper Pleistocene stages of evolution of major stream channels in the drainage system. Introductory chapters discuss lithic implement manufacturing technique and the typology used by the author, as well as geomorphology (especially the evolution of river systems affected by the close proximity of glacial ice) and present a descriptive and evolutionary scheme for the three major industrial complexes (Clactonian, Acheulean, "Levalloisian") Wymer recognizes. The catalog-cum-gazeteer divides the region into 11 sections, each of which is treated separately in detail. Summary chapters discuss the place of the Thames drainage finds in the total British sequence and relate that sequence to the general picture of Lower and Middle Paleolithic developments in Europe and Africa.

The catalog is by far the most valuable as well as the bulkiest part of the book. More than just a list of sites, it documents very nearly all the recognized Lower Paleolithic artifacts from the region (except those in some private collections) in a fashion which is exhaustive to the point of triviality: two "sites" listed on page 84, Broadwell and Yelford, are finds of bifaces in footpaths made of gravel of uncertain origin; numerous surface discoveries with only roughly approximate locations are documented. For most of the localities, apparently complete bibliographic references are given. The area treated is, of course, a key one for any understanding of British Lower Paleolithic prehistory, and includes such famous sites as King's Cross Road (Gray's Inn Lane), locale of the earliest recognized discovery of a Paleolithic implement from Britain, the Swanscombe pits, including the Galley Hill ones, Furze Platt and the Maidenhead complex, Stoke Newington, Little Thurrock (Grays Thurrock), Crayford, Baker's Hole, and dozens of others of crucial importance. Nutshell descriptions of the stratigraphy and artifacts from these sites are not elsewhere to be found in one reference.

Some aspects of the work need to be treated with reservations. At best, Wymer's flake tool typology is sketchy: the pieces in the categories "points" (Nos. 10, 11, 129, 131) and "endscrapers" (No. 48) are not consistently grouped, nor do the categories bear any resemblance to the types with these names recognized in good Western European practice. The so-called Levalloisian collections are most inadequately treated. Wymer's category "Levallois flakes" includes retouched flake

tools made on Levallois flakes indiscriminately with unretouched pieces (Nos. 79, 138, 157). Several further, though minor, points of irritation exist. Wymer perpetuates the fallacy that the categories "flakes with faceted butts" and "Levallois flakes" are synonymous and curiously uses the term "reverse" to mean dorsal surface, rather than ventral surface as is customary elsewhere. Figures are not located in order in the text. Given small samples, there are (as Wymer recognizes, p. 378) difficulties in distinguishing Middle Acheulean collections from Late Middle Acheulean collections by the criteria he proposes.

Other flaws are major. Wymer discusses relationships between the Boyn Hill and Lynch Hill terraces in some detail, using the former designation for the highest "terrace" at Maidenhead and the latter for a depositional phase on a lower bench (p. 211). Basing his decision on the occurrence of "more evolved" artifacts (of Late Middle Acheulean type) in the Boyn Hill "terrace" and of less evolved tools in the lower terrace, he concludes that the lower terrace is actually the older (pp. 243, 244, 392). Admittedly, a decision about the chronological relationships of these "terraces" cannot yet be made on geological grounds because the necessary field geology has not been done. However, no proposal that the relative ages of these formations be decided solely on the basis of contained Paleolithic artifacts is legitimate. Another serious defect is Wymer's readiness to accept minimal evidence, sometimes of a very unreliable kind, in tracing the geographic and temporal range of industrial complexes: the so-called Levalloisian industry is postulated to exist between Lechlade and Dorchester from the end of the Gipping into the Weichselian glaciation on the basis of two Levallois flakes, one a surface find (p. 87) and the other with "no exact provenance" (p. 95).

One is struck by the inadequacy of past geological and prehistoric investigations of Lower Paleolithic occurrences in this critical area. Wymer deserves to be commended both for his own contribution to the study of individual localities and for having produced this major attempt at synthesis in a region with such a highly complex and difficult depositional history.

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On Pollution Problems

Advances in Environmental Sciences. Vol. 1. JAMES N. PITTS, JR., and ROBERT L. METCALF, Eds. Wiley-Interscience, New York, 1969. viii, 358 pp., illus. $15.95.

This book is intended to be the first in a series of multiauthored books concerned with the study of the quality of the environment and with the technology of its conservation. The series is to serve as an aid to the established professional and also to encourage students to take up careers in this field.

This volume opens with a chapter entitled "Outline of environmental sciences." To the student who might be encouraged to enter the field, this review will probably be the most challenging and interesting in the book. In fact, environmental science and technology are today so fragmented that this chapter will be of value to most professionals in the field who are engaged in a very narrow specialty.

This chapter is followed by one on the legal aspects of pollution abatement and control at the federal level. It concludes with a discussion of the author's ideas with regard to the government's future role.

The third chapter deals with water pollution control and management. Like the first, it covers a tremendous subject in a few pages (30), but provides a readable review for someone who would like to see an overall picture of this important subject.

Three chapters scattered through the remainder of the book deal with the chemistry of air pollution. They will be of use primarily to the specialist, although they may also be of interest to graduate students in chemistry who are considering a career in air pollution research or control. Considerable knowledge of chemical kinetics and photochemistry is required to follow the discussion and arguments presented. In spite of these limitations, the three chapters should prove to be very valuable to chemists investigating photochemical smog, since they bring together information with regard to techniques and results which has been scattered through a large number of journals of various types.

Other chapters cover such subjects as biodegradable detergents, aeroallergens, and the catalytic removal of potential air pollutants from automobile exhaust. All of these are readily understandable to the generally well-educated reader.

For the most part the chapters are excellent, though not comprehensive, reviews rather than "advances." Perhaps this is appropriate for the first volume of such a series; however, it might be hoped that future volumes will be more concerned with recent developments. The series seems to be off to a good start and should fulfill the purposes described by the editors.

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The Growth of a Science

The Chemistry of Life. Eight Lectures on the History of Biochemistry. JOSEPH NEEDHAM, Ed. Cambridge University Press, New York, 1970. xxxii, 216 pp. + plates. $9.50.

This book is the outcome of a series of lectures delivered by biochemists of the University of Cambridge between 1958 and 1961, under the auspices of the history of science department. Joseph Needham has now collected and edited them, with an extensive introduction dealing with what might be called the prehistory of biochemistry, from the earliest times to about 1800. As might be expected, there is much here of Chinese as well as of Western thought and experiment, and Needham's extraordinary range of learning enables him to note many relations that few others could have perceived.

The chapters that follow are diverse in scope and approach. Robert Hill considers the growth of our knowledge of photosynthesis, dwelling chiefly on early work and speculation, before Lavoisier and Priestley. The vast and complex developments that have occurred since are covered in less than four pages, in which it is impossible to give more than hints of what actually occurred. Malcolm Dixon considers the history of enzymes and of biological oxidations; he provides a useful introduction which should be helpful to students of biochemistry, and others, in providing some perspective on the development of this central area of biochemistry. As Dixon notes, David Keilin's posthumous *History of Cell Respiration and Cytochrome* (1966) treats one of the two topics considered here (biological oxidations) in much greater depth.

E. F. Gale presents the development of microbiology in 22 pages. Inevitably this brief sketch of a vast field covers