

None of this is a criticism of the individual papers, most of which are excellent and a few of which are indeed comprehensive reviews of the fields indicated by their particular titles. The contributions on chemical lasers and on hook interferometry perhaps deserve special mention. The comments concern only publication policy and, since this invariably succeeds, are a futile gesture anyway; if we cannot obtain relevant reprints from individual authors we shall just have to pay \$16.24 for the entire volume.

F. J. WEINBERG

Aromaticity

Aromaticity and Anti-aromaticity. (International Symposium held at Jerusalem, April 1970.) Edited by Ernst D. Bergmann and Bernard Pullman. Pp. 398. (The Israel Academy of Science and Humanities: Jerusalem; Academic: New York and London, July 1971.) \$21.50; £10.05.

"WHERE have we anything to do with Mechanical Chymistrie that hath outstript the other Sects of Philosophy by her multiplied real experiences?" asked the Puritan, Noah Biggs, in his *Chymia-trophilos* of 1651, addressed to the Parliament of England. The present volume of quantum mechanical and physical organic chemistry devoted to the subject of aromaticity would doubtless have gratified Biggs, but he may well have felt that a subsidiary project in his grand design for the advancement of learning was left incomplete. "Where," he asked further, do we have "a Review of the old Experiments and Traditions, and casting out of the rubbish that hath pestered the Temple of Knowledge?"

The thirty-four contributions to the symposium held in Jerusalem in 1970 circle round the elusive concept of aromaticity with new calculations, new measurements and new syntheses, each attempting a closer definition. The new studies lead, however, to a fragmentation of the concept and generate overlapping sub-classes distinguished more perhaps by their prefix, pseudo-, anti-, quasi-, non-, homo-, and even pseudo-anti-aromatic, than by their content. As Heilbronner observes (page 22), many molecules might be termed "schizo-aromatic", for the allocation of a molecule to a sub-class depends on the particular chemical or physical property or theoretical measure used as a criterion. A possible exception may be the paradigm case of benzene, the arche-aromatic (Lloyd, page 89).

Historically, the concept of aromaticity has played a major role in the development of physical-organic and π -electron chemistry. Beginning as a loose description of compounds with an agreeable

aroma, "aromatic" became, with Kekulé (1865), an archetectonic term describing the molecular structure of six-membered ring compounds related to benzene. Classically molecular structures were proposed chiefly to account for chemical reactions, as opposed to physical properties, and aromatic substances came to be primarily characterized by their substitution reactivity (Robinson, 1925). Quantum chemistry introduced the new criterion of electronic structure in Hückel's rules (1931) and emphasis shifted to the electronically-dependent physical properties. Studies of these properties have undermined the old distinctions and introduced new ones which are far from concordant among themselves. The proceedings of the 1970 Jerusalem symposium suggest that the concept of aromaticity is a Wittgenstein ladder which chemists have climbed and now, on reaching the top, should throw away.

S. F. MASON

Air Pollution

Air Pollution Control. Part 1. (Environmental Sciences and Technology: Wiley Series of Texts and Monographs.) Pp. ix+451. (Wiley: New York and London, August 1971.) £9.50.

THIS is not a book on air pollution control, it is a set of seven disparate review articles on equally disparate subjects, bound up together. The reviews on the collection of particles by fibre filters, forty pages, and condensation effects in scrubbers, fifty-two pages, are both theoretical accounts with notes on experimental work to back up the theory, but little about practical applications. Both could be quite useful to a newcomer to research and development in these narrow fields, for the authors were allowed a reasonable space in which to expound their subjects and used it well. By way of contrast the author of the review on the dispersion of pollutants attempted valiantly to deal with this complicated and difficult topic in thirty-four pages. The rather breathless rush towards the end prevented adequate treatment of what promised to be the most valuable part of the chapter. In contrast again, the review on electrostatic precipitation occupies 110 pages on "updating prior surveys . . . with the emphasis on physical principles and predictive methods rather than on equipment and empirical descriptions". It ends, however, with a useful and wise, although all too short, discussion on applications, costs, difficulties and so on.

The chapter on the formation and control of oxides of nitrogen is a well balanced review of the role of these substances as air pollutants, as is also that on the control of internal combustion engines. This latter gives

essential practical details often lacking in some accounts of motor vehicle problems.

The remaining article, on the control of sulphur emission from combustion processes, is a very mixed bag indeed, and I was left with the uneasy thought of what the reader could conclude from it as to the present state of the art in these fields. While a great deal of accurate and useful information is presented it is mixed up with the pipe dreams of inventors of an earlier generation and no key to the maze is given. In some instances the information is inaccurate in fact, in others by implication. For example, it is stated that a Howden-ICI cyclic lime process was installed at Fulham power station in 1935 and a flow diagram and explanation of the method is given. It is not stated that the plant was shut down in 1939 and that the process is as dead as the proverbial dodo. The fact that, later in the chapter, the author copies out a detailed table of costs raises suspicions that he is not himself aware of the true position. The Fulham-Simon Carves ammonia process is described and it is stated that the North Wilford plant, commissioned in 1957, "handles the combustion waste gases from . . ."; it does not, as it was shut down some ten or eleven years ago. This sort of thing destroys confidence.

Looking back at the book as a whole, all the chapters contain excellent collections of references, and some of them consist, in effect, of useful sets of notes on these references. As such it has a certain real value, but a value that is very small indeed in relation to the price of £9.50 for the 451 modest sized pages. Perhaps for the first time I have understood my American colleagues who try to buy all their private technical books from British publishers in the United Kingdom.

S. R. CRAXFORD

Time Past

Geological Time. By J. F. Kirkaldy. (Contemporary Science Paperbacks No. 46.) Pp. 133. (Oliver and Boyd: Edinburgh, April 1971.) 37½p.

BEGINNERS in geology often find difficulty in comprehending the enormous span of geological time. A million years is difficult to appreciate. But since an understanding of the duration and significance of time intervals is important in most branches of geology, the sooner that these figures are understood the better. What the author has done has been to explain in simple language why time is so important in geology and how it is measured.

The first chapter is a brief historical survey of ideas of the age of the Earth, showing how ecclesiastical dogma was dominant up to the nineteenth century.