This big unconformity is regional for western and southern Arabia from Yemen and Aden to Dhofar. Fossiliferous Cambrian is known only from the Dead Sea, where it is followed by marine Triassic. Oman and eastern Saudi Arabia have marine Palaeozoic and Triassic below the transgressive Jurassic. The Eastern Aden Protectorate Jurassic is highly fossiliferous and its evaporites have given rise to salt domes on the western frontier with Yemen. Dr. Beydoun considers the salt to be of Jurassic age and diapiric in action, contrasting with the accepted Cambrian age of the Oman piercement plugs and the Miocene age of the Red Sea ones.

I was struck by the anomalous trend of the evaporite facies line in this area, west-north-west–east-south-east, the same as the faults among which the domes are located, and wondered if there was a genetic connexion.

The facies lines of the rest of the Jurassic and of the Cretaceous are north–south from Saudi Arabia to Somaliland. The Jurassic of the Eastern Aden Protectorate and Yemen correlate well, including the evaporite facies.

The Cretaceous consists of sand in the west and limestones and marls in the east, and this period and the succeeding Tertiary one of limestones, shales and evaporites are subdivided into litho-stratigraphic units which are described in detail with faunal lists and regional correlations.

The dominant structure of the Eastern Aden Protectorate is the gentle east–west geo-anticlinal Hadhramut arch in Palaeocene limestone forming a plateau between the sands of the Rub-al-Khali and the Gulf of Aden.

There is no space in this review for the controversial rift-fault tectonics which dominates the last twenty pages on structure, especially as Dr. Beydoun quotes fully many publications on neighbouring areas. In conclusion, he and his sponsors (Iraq Petroleum) are to be congratulated on a very valuable contribution to the geology of this remote region. He and his assistants and colleagues deserve high praise for their strenuous and painstaking field mapping under adverse topographic conditions—well illustrated in the photographs. F. E. Wellings

## A USE FOR MATRICES

### The Matrix Analysis of Vibration

By Prof. R. E. D. Bishop, G. M. L. Gladwell and S. Michaelson. Pp. x+404. (London: Cambridge University Press, 1965.) 100*s*. net.

*THE Matrix Analysis of Vibration* is basically mathematical and it treats the subject of matrices in a much more general manner than might be associated with the title's particular association of it with vibration. The nature of the answers to many of the numerous examples makes this clear, but others show that the reader is recommended to do a fair amount of numerical computation in order to ascertain the tenacity of his grip on the process of practical application of matrix methods and also no doubt to give him some idea of the tedium and irritation that are liable to be found in long calculations that are unavoidable in solving certain types of vibration problem.

As the first step in making calculations in connexion with vibration of any actual system, simplifying assumptions are used in representing the physical attributes of the system by symbols or numbers. Out of these it is usually possible to build an equation or equations. The next stage is the purely mathematical one of solving the equations, and it is with this stage that this book is almost wholly concerned.

As the matrix method is not applicable to a system with an infinite number of degrees of freedom (and strictly, this means every system) the book considers in some detail the problem of determining the dimensions of a "lumped-mass" system closely equivalent to the actual system. The labour of solving the equations is then left to a digital computer. It is odd to recollect that before such aid was readily available, lumped mass systems were sometimes replaced by distributed mass systems in order to ease calculation by the conventional methods of the time.

Mention is made of the fact that where the equation representing a vibration problem is found to be highly sensitive to small changes in the arguments, the physical system is likely to be correspondingly temperamental. If it is, close prediction of its behaviour is impossible and so meticulous calculation may be purposeless.

The note on p. 227 that two methods of calculation give results differing by only 0·645 per cent inspires the remark that a discrepancy of ten times that amount is gratifyingly small in quantitative predictions of torsional vibration in some practical cases. This is, perhaps, not a valid comment in reviewing a book that is avowedly mathematical and that deals very clearly and very thoroughly with the principles and practice of using matrix methods for solving linear equations with large numbers of unknowns.

The question as to whether any particular vibration problem can be solved with adequate accuracy and speed without resorting to matrix analysis is usually one that demands attention from both the engineer and the mathematician, if it is asked at all. Whatever the answer may be, calculation in practice is preferably carried out in at least two different ways, even if none of them is rigorous, in order to obtain some safeguard against gross errors.

W. A. Tuplin

## PROGRESS IN MAGNETISM

### The Theory of Magnetism

An Introduction to the Study of Cooperative Phenomena. By D. C. Mattis. Pp. xvi+303. (New York and London: Harper and Row, 1965.) 86*s*.

### Physics of Magnetism

By Prof. S. Chikazumi. English edition prepared with the assistance of Stanley H. Charap. (Wiley Series on the Science and Technology of Materials.) Pp. xii+554. (New York and London: John Wiley and Sons, Inc., 1964.) 120*s*.

HISTORIES of physics and magnetism have much in common, beginning with the discovery of the lodestone by the Greeks. Modern texts on magnetism tend to overlook the work of past philosophers and it is very refreshing to find such an excellent account of the past introducing the main text of the first book.

A student fresh to the theory of magnetism is confronted with literature of alarming proportions. *The Theory of Magnetism* attempts to organize this material by treating magnetism essentially as one of the most important examples of co-operative phenomena. The emphasis throughout is on strong interactions between two or more particles and especially those between electrons and spins. The book itself begins with a review of the quantum mechanical idea of exchange and discusses various concepts derived from it. Magnetic moments are measures of angular momentum, and thus a detailed quantum mechanical discussion of angular momentum is given. Important relationships, formulae and tables are presented in an unorthodox but very attractive way. Many electron wave-functions complete the mathematical basis of the theory and most of the more important theorems and rules are clearly presented.

Spin waves form the principal topic of the book, and thus a study of the statics and dynamics of magnetism follows. It commences with a semi-classical treatment and leads to the introduction of magnons and concludes with spin waves in insulators. Magnons in metals are treated separately and are derived from detailed discussions of the properties of electrons in metals. The third and final