

If we are still left guessing, in many instances, as to what really was the nature of particular rocks and minerals described, this is inevitable. To arrive at the precise meaning of terms used in an ancient text on mineralogy, petrography and related subjects must always be a matter of great difficulty, even when, as in the preparation of this book, scientist and classicist have collaborated. The names used for common rocks, minerals and ores often bear no resemblance to those in use to-day, or when they do they may refer to different substances, or to more than one substance. In the English text where no certain translation can be given, the original Greek terms, transliterated into Roman characters, have been retained; and probable or suggested meanings are discussed in the commentary. By using this commentary at least some pitfalls can be avoided, such as the assumption that *smaragdus* is necessarily equivalent to emerald.

The editors have brought wide knowledge to bear on the problems raised. Their discussion of these problems, as well as the text itself, will have a permanent value for reference purposes, and their book is a notable contribution to the source material for the history of science. V. A. EYLES

SOCIOLOGY OF STATISTICS

Statistical Theory

The Relationship of Probability, Credibility and Error. By Prof. Lancelot Hogben. Pp. 510. (London: George Allen and Unwin, Ltd., 1957.) 45s. net.

A FUNCTION of theoretical statistics is to provide rules that will enable the practical statistician to form or modify his judgments, both in the interpretation and in the design of statistical experiments. Some presentations of the theory seem to imply that human judgment is so fallible that it must be entirely eliminated. On the other hand, members of the neo-Bayes-Laplace school emphasize that the raw material of statistics must include subjective or multi-subjective judgments of probabilities and utilities. The original Bayes postulate was an assumption of equidistribution of initial probabilities; its purpose was to avoid the need for judgment, but the postulate leads to inconsistencies. The first systematic attempt to avoid its use was by the Fisher school. This school has in its turn been criticized by Jeffreys, Wald, Neyman, Carnap, and by the neo-Bayes-Laplace school.

Prof. L. Hogben uses many of the criticisms that the various schools level at one another, together with some new criticisms of his own, but he gives no explicit reference to members of the neo-Bayes-Laplace school. His case against theories of subjective probability consists of sarcasm or wit, for example (p. 10): "This book is a prosaic discussion about public probability. If the topic were private, the author would have communicated his convictions through the medium of verse composition". This remark is surprising, since biologists often discuss private matters in scientific terms. As a matter of fact, Prof. Hogben's prose is often almost as difficult to understand as poetry is: he seldom uses one word where two will do.

After an extensive attack on Fisher's statistics, Prof. Hogben shows some sympathy with modern decision theory, but on p. 466 he says: "It [an *impasse*] forced Wald to enunciate the *Minimax*

solution which is wholly arbitrary, embodying a concept of decision which is ostensibly behaviouristic but on closer examination consistent only with the view which locates probability in the mind". If the mind is so shocking, then it would be simpler to criticize decision theory by pointing out that utilities are in the mind, especially the utilities of scientific theories.

One of the interesting features of the book is the historical and sociological approach. Some statistical fallacies are attributed to the transfer of methods from the fields of application that inspired them to new fields for which they are less appropriate. A strong warning is given against the reliance on authority, for example on p. 316, yet on pp. 431-432 there is an admittedly dogmatic set of four 'Canons'. For example, Canon 1 is: "A necessary condition for prescribing a rule of stochastic induction is that we can specify for each elementary hypothesis endorsed as admissible by one of the set of acceptable terminal statements a *unique* sampling distribution of admissible observations".

We recall the first page of the "Golden Bough" and the slogan of Belloc's Leader of the Opposition, "We shall achieve Anarchism by constitutional means".

Apart from the Canons there are three theses on p. 454. They favour a long-run-frequency interpretation of probability, following von Mises, "unless we rely on axioms which are not susceptible of proof". The normative axioms of subjective probability have, however, been made extremely convincing, and the obvious solution is to accept them if we are otherwise faced with an *impasse*.

The important point is emphasized that statistics are no substitute for real thought. Many biologists apply Fisher's statistical techniques merely because they are socially acceptable, especially to Fisher. Statistics have an important but not an over-riding part to play, and their philosophy is perhaps as important as their mathematics.

In spite of its faults this book will provoke much useful thought.

I. J. GOON

REALITY EXPLORED

In Search of Reality

By Viscount Samuel. Pp. ix+229. (Oxford: Basil Blackwell, 1957.) 28s. 6d. net.

THE title of this book is exactly right: Lord Samuel is taking his readers with him on a search for reality, with no easy promises that he, or they, will find it. Indeed, by suggesting the question whether there is any such thing as reality, the author has gone some way towards gaining his ends, for he has discouraged superficial solutions, and focused attention upon basic principles. Neither in philosophical theories nor in social institutions lies the answer, but fairly and squarely within the individual and his personal responsibilities.

To a considerable extent, this is the reason why there is so much noise and confusion regarding the parts to be played by philosophy, religion, and science in the twentieth century. They tend to be taken as convenient systems, the effect of which is to dilute the desire—and perhaps even the capacity—for personal thought. The word 'theology' does not appear in the index, though 'religion' does twice, and occupies a couple of chapters. So far so good, but in the Middle Ages (and Lord Samuel is strong on his