eters of all these interactions between mean and fluctuating motions by means of an eddy viscosity relating local "eddy" stress to local rate of strain, the coefficient may well be negative; it may be meaningless.

The author seeks to interpret many fascinating examples of flow in the earth's atmosphere, the solar atmosphere, ocean circulation, and laboratory experiments in terms of an eddy viscosity. The viscosity is, of course, found to be negative whenever concentrations of flow exist or whenever energy is transferred from smaller to larger scales. For one who understands some fluid dynamics a description of these effects in terms of a negative viscosity is entertaining to read; for others it will surely make them even more mysterious than they are.

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A Method for Dating

Thermoluminescence of Geological Materials. Proceedings of a NATO Advanced Research Institute, Spoleto, Italy, 1966. D. J. MCDOUGALL, Ed. Academic Press, New York, 1968. xvi + 680 pp., illus. $25.

The papers in this volume stem from a 10-day conference at which 62 papers by 72 authors were presented. As is the case with many symposium volumes, the contributions range from trivial to important, and fully half of the papers could have been omitted with no loss to total information content of the volume. The papers can be grouped under the general headings of theory, instrumentation, and applications.

Unfortunately, thermoluminescence theory is today at best a palimpsest, thinly embracing a relatively rich phenomenology and supplying little guide to the successful application of thermoluminescence to geological and archeological problems. Theory seems to provide little explanation for such phenomena as the initially rapid change with time in the rate of depopulation of high-temperature traps, the effectiveness of radiation at high energy levels in the creation of new traps, the relationship between triboluminescence and thermoluminescence, or grinding glow, nor does theory predict that thermoluminescent glow curves should only be measured in an oxygen-free environment. A measure of the lack of theoretical guidance is that many of the authors of the book dismiss portions of signals that are not understood as "spurious."

Unfortunately, the chapters on design and instrumentation are particularly unenlightening. One is cautioned to have an instrument "able to record with high fidelity," that design of the apparatus should be "considered in its broadest overall aspects," and that "properly designed equpiment will provide operational convenience"; one is warned to "avoid the expense of overdesigned functional sections and inadequacies of underdesigned functional sections." In this section one is also informed that "manual control is a method of operation in which the rate is controlled by the operator." We are also told that "a detector is a device which responds to the phenomena being investigated," we are instructed to select a "suitable device," and finally we are told that "the design should accurately tailor the equipment to the measurement needs in every respect."

A substantial number of papers appear under the general heading Applications of Thermoluminescence. A series of papers on geological age determination could be summarized by the single sentence, It can't be done. Thermoluminescence of a mineral is determined not only by its total radiation dose but by saturation of traps, production of new traps with time as a result of radiation damage, drainage of traps, which is a function of thermal history, and the creation and drainage of traps as a function of stress history. It is clear that because of the uncertain history of the average mineral in a geological environment thermoluminescence can give relatively little age information. Even in ideal situations where the thermal history of material is known and most of the variables that can affect thermoluminescence are not operative, such as in recent lava flows, age dating results are not very encouraging. Aitken *et al.* show that the feldspars of the Mount Etna lavas range in thermoluminescence from 0.1 to 90 times the expected glow. Therefore this reviewer cannot agree with the enthusiastic remark of one contributor to this volume that "thermoluminescence can furnish much valuable information about the age of igneous intrusions, faults and metamorphic events."

Dating of archeological artifacts by thermoluminescence seems to be far more promising and on far better ground. Papers by Ralph *et al.* and Aitken *et al.* describe the techniques of archeological age measurements on pottery sherds. In both precision and accuracy, their results do not compare unfavorably with carbon-14 results. It seems likely that in the not too distant future thermoluminescence may become a routine archeological tool.

Unfortunately, it seems likely that many of the other attempted applications of thermoluminescence, such as the determination of paleotemperatures and the determination of geological temperatures, will fail, for the thermoluminescence clock or dosimeter is not sharply set by the event in question, as is the case with the firing of a ceramic pot.

In particular, in this volume the contributions from Oxford by Aitken and his co-workers stand out as of exceptional quality, and they should particularly be read by anyone interested in the application of thermoluminescence to archeological or geological problems.

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Nucleases and Substrates

Enzymes in Nucleic Acid Research. MICHEL PRIVAT DE GARILHE. Hermann, Paris; Holden-Day, San Francisco, 1968. xiv + 393 pp., illus. $16.25. Chemistry of Natural Products.

This volume naturally falls into two separate parts. The first half serves as an introduction to the structure and origin of nucleic acids and analytical methods for studying them, whereas the second half is apparently a revision of the author's earlier book, *Les Nucléases.*

The first part, evidently written so as to make the book conform to the natural products theme of the series, discusses the nomenclature, basic concepts, synthesis, and isolation of nucleic acids. These chapters tend to be written in a confusing style, which often leads to self-contradictory statements and half-truths. To cite only a few examples, on page 29 we are told that there exist three classes of RNA and on page 37 that there are four, and on page 38 a fifth type is discussed. On page 30 we are told that the messenger RNA's are "unstable, since as soon as they have delivered their message, they should