Book Reviews

Stratigraphic Geology. Maurice Gignoux. Translated from the French ed. 4, 1950, by Gwendolyn G. Woodford. Freeman, San Francisco, 1955. xii + 682 pp. Illus. $9.50.

For those who are familiar with the French edition of this work, there need only be said this is an excellent translation. E. Hang's classic treatise appeared in 1918 and was already outdated in part when the first edition of M. Gignoux's work appeared in 1925. The fourth edition in 1950 gave a growth of 25 years during which considerable new geologic knowledge was discovered, and the fourth edition was justified. Following a short introduction where definitions, methods, and nomenclature are discussed, we find Chapter 1 on the Precambrian formations. Under Precambrian are summarized available information of the various areas, but the author says, "In spite of everything, this immense Precambrian period, in the present state of our knowledge, offers little of interest from the point of view of stratigraphic syntheses. . . . With the Cambrian, however, we shall enter the true domain of stratigraphic geology."

Then are taken up the Cambrian, the Silurian, the Devonian, the Permo-Carboniferous, the Triassic, the Jurassic, the Cretaceous, the Nummulitic or Paleocene, the Neogene, and the Quaternary. American geologists will miss the Ordovician, the Pennsylvanian, and the Mississippian and may dislike the use of the Nummulitic but the use is justified by the author. The general treatment in each chapter is a brief introduction and/or discussion of the fauna, then the various facies with the European and neighboring regions, then the North American facies. In the Permo-Carboniferous Gondiwana Land is examined; although Gignoux does not follow Wegener's ideas, he retains E. Argand's mobility and concludes that part with a comparison of the classic area (Europe) with the "calm and somnolence of immense Africa . . . our feverish Mediterranean is abnormal and it is in Africa that the normal history of a great continent is inscribed." The Nummulitic or Paleocene is the more familiar lower Tertiary (Eocene and Oligocene), and here the regions from the Paris Basin into North Africa are dealt with in some detail. The Neocene handles the Miocene and Pliocene with no discussion of the American deposits. The Quaternary is distinguished from the Tertiary by man and the Pleistocene glaciation. Here we get mammal remains and tools of man in the same deposits. We have tundra, steppe, and forest flora. We have Paleolithic and Neolithic tools, but the author does not consider areas much beyond the margins of glaciation. He closes with a quotation of Bergson, "l'univers est un machine à faire des dieux."

Here available in English is a volume that should be widely read in North America. It brings together an immense amount of valuable information with good, though small, maps, and correlation tables of area that too many of our students do not know. The references are numbered in each chapter but are not indexed, although the text is so handled. They would be better as footnotes but this is a very minor difficulty.

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The Crime of Galileo. Giorgio de Santillana. University of Chicago Press, Chicago, Ill., 1955. xv + 338 pp. Illus. $5.75.

In this fascinating book, Giorgio de Santillana reexamines the historical documents relating to the trials and condemnation of Galileo and attempts to estimate the basic significance of the affair. He is well qualified to do so on many grounds, and the result, so far as the account of the actual course of events is concerned, is probably the most balanced and trustworthy now available. The assessment of significance, however, is more controversial. De Santillana draws a parallel between the Galileo case and the recent treatment of geneticists in the U.S.S.R. and of Oppenheimer in the United States. In all of these incidents he sees "the scientific mind as it has ever been—with its free-roaming curiosity, its unconventional interests, its detachment, its ancient and somewhat esoteric set of values . . . surprised by policy decisions dictated by 'Reasons of State' or what are judged to be such."

The suggestion is interesting and thought-provoking, but it seems to demand an undue simplification of the matter. There are three distinct aspects of the dispute between Galileo and the Inquisition: first, the issue as the protagonists saw it, the conscious motives that actuated them at the time; second, the ostensible reasons for the condemnation of Galileo, the evidence which was produced and on which the decision was given; and third, the significance of the whole incident in the wider context of human history, on which only those of later times who have experienced its consequences are in a position to pronounce. The outstanding value of de Santillana's book is its contribution to our knowledge of the second of these. No one who has not studied the documents is qualified to criticize his statements, but there is no reason to question their accuracy, and it appears abundantly clear that the case was decided largely on the evidence of false documents, contributing to "a plot of which the hierarchies themselves turned out to be the victims no less than Galileo."

The other two aspects of the case are, of course, of more permanent importance, and we cannot help feeling that in drawing his analogy with modern events de Santillana has not sufficiently distinguished those aspects. For although—to speak in the most general terms—the wider historical significance of the case relates to the conflict between the "scientist" on the one hand and religion or "Reasons of State" on the other, this was not the form in which it appeared at the time, when the distinction between the scientist and the religious philosopher had not arisen. There was but one question: What is the truth of the matter; does the earth move or not? and to that question biblical, ecclesiastical, and observational evidence was alike relevant. Where they appeared to clash it was not a matter of the "scientist" taking one side and the "authorities" the other. Each accepted all lines of evidence as equally valid, and the problem of how to reconcile them is represented in our day by that of reconciling the wave and particle theories of light rather than the biblical and evolutionary theories of the origin of species. On both sides were "scientists" and "theologians," and Galileo's letter to the Grand Duchess Christina, for instance, is not an acceptance of "science" and a rejection of "authority" but an assessment of the relative contributions of the two lines of evidence to the solution of the common problem. For this reason it is hard to see the justice of de Santillana's parallel.

The presentation is curiously complex in character. It is somewhat verbose and

overcrowded with footnotes, which stifle the effect that a continuous narrative might have given. On the other hand, there are numerous flashes of insight into the significance of an act or the character of an actor that suddenly light up the situation and almost justify the rather drab setting without which they would not stand out so clearly. But the interest is maintained throughout, and the reader feels that he has been admitted not to a drama of the imagination but to events that actually happened.

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Applications of Spinor Invariants in Atomic Physics. H. C. Brinkman. North Holland, Amsterdam; Interscience, New York, 1956. 72 pp. $3.25.

This slim monograph is intended to introduce the physicist to spinor invariants and their use in atomic physics. The development of these methods was initiated by H. A. Kramers, to whose memory the book is dedicated. Spinors and their invariants are introduced into atomic physics systematically, not only to treat the electron spin but for all quantities that might otherwise be represented as spinors, vectors, or tensors. That this is possible is well known. All of these quantities have transformation laws that are representations of the three-dimensional orthogonal group or, in relativistic theories, of the four-dimensional Lorentz group. They may be obtained from the representation by spinors as multiple Kronecker products. In less technical language, a vector is equivalent to a set of quantities bearing two spinor indices, and so on. Accordingly, the possibility of formulating all the more important results of invariance-theoretical considerations in spectroscopy by means of spinors and their invariants is beyond doubt. Whether it is desirable, as a means of unifying a variety of different results and considerations, is largely a matter of taste.

The book is divided into three major parts: the first deals with the formal relations between three-dimensional rotations in a real space and two-dimensional unitary transformations in a complex space; the second is devoted to the construction of wave functions for systems containing N spinning electrons; and the third deals with some more detailed calculations, including spin-orbit interaction and intensities of spectral lines.

The presentation is on the whole clear and straightforward. In my opinion the presentation of the foundations would have gained much if it were less formal. As it is, the introduction of spinors appears contrived and artificial. A reader who is already familiar with spinor theory will have little difficulty in this respect, but he does not require the wealth of mathematical detail offered in the first part. Aside from this criticism, the author should be commended for building the theory step by step, treating, for instance, the scalar (nonrelativistic) electron before introducing the Pauli electron. Whether the omission of Dirac's relativistic theory can be justified is another question.

Because of the somewhat historical nature of the subject matter, including the restriction to nonrelativistic atomic physics, it is questionable whether a monograph was the ideal form of publication for this article. Articles of similar scope are frequently published in such journals as the *Reviews of Modern Physics*, whose subscription price for a year is only slightly higher than the price of this book.

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Nuclear Radiation Detectors. J. Sharpe. Methuen, London; Wiley, New York, 1955. 179 pp. $2.50.

This little volume is one in the well-known series of Methuen's Monographs on Physical Subjects. It covers virtually the entire field of nuclear radiation detectors in 180 small pages. There are six chapters containing the following material: Chapter I, introduction, is a brief qualitative description of the basic processes involved in detection. Chapter II is more specific and more quantitative and describes the interaction of neutrons, gamma rays, and charged particles with matter. A short section of this chapter discusses Cerenkov radiation. Chapter III, on detection media, is a larger chapter describing phosphors and scintillating crystals, secondary emitters, crystal conduction counters, and gaseous ionization media.

The efficiency of detectors is covered in Chapter IV. This material includes solid angle considerations, window absorption, electron yields from the walls of Geiger counters, and so forth, and a section on mean level detectors (as distinguished from detectors counting individual events) and dosage measurements. Chapter V is concerned with the scintillation counter. In this chapter, one finds a brief discussion of the photomultiplier, an unexpectedly large section on alpha-particle scintillation counters, some discussion of the uses of scintillation counters as electron and gamma-ray energy spectrometers, and a cursory account of fast-and-slow-neutron scintillation counters.

Chapter VI is the last and largest chapter and is concerned with gaseous ionization devices, such as ionization chambers and counters, proportional counters, Geiger counters, Geiger-Müller counters and their various properties. One can see from the rather ample list of topics discussed by Sharpe that, on space considerations alone, a thorough handling of each subject would be impossible. Yet the detail presented is quite surprising, and in many respects the work is written with authority. The author is obviously well grounded in many of the various fields he chooses to describe.

The diagrams and other drawings are well chosen; the tables are quite informative and up to date. Mathematical expressions appear to have been selected with attention to their basic importance. I am much impressed by the last chapter on gaseous ionization detectors.

There are a few minor matters that I noticed which may need a little comment. The general method of growing NaI(Tl) crystals uses the Bridgman method rather than the Kyropolous method (p. 121). The decay constant of ZnS-Ag has been reported by Koontz to be faster than the 3×10^{-6} sec given on page 126. The Sternheimer reference (33), on page 36, to energy loss of electrons has been rendered obsolete by a later Sternheimer reference (*Phys. Rev.* **91**, 256 [1953]).

All in all, I heartily recommend this little volume to veterans of the field as well as to beginners. If a concise book on nuclear-radiation detectors is needed, then this book is *it*. It is to be hoped that Sharpe may someday be willing to expand the material into a full-length venture.

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Protoplasmatologia. Handbuch der Protoplasmaforschung. vol. VIII, *Active Transport through Animal Cell Membranes.* Paul G. Lefevre. Springer, Vienna, 1955. 123 pp. Illus. $9.

In the branch of cellular physiology that deals with "permeability," the notion of "active transport" has gained considerable ground during the past few decades. In his discussion of this development, the author places emphasis on the lines of investigations that have to do more or less directly with the activity of cells in the translocation of substances through the cell surfaces and avoids including other physiological processes that conceivably might fall under the heading of the volume but would necessitate ad-