perative the analytical control of this compound before use.

A new form of ATP, the disodium salt $Na_2H_2ATP \cdot 4H_2O$, has recently been developed in these laboratories, and its stability has been under investigation for the past six months. We are reporting the preliminary results of this study, which will be of interest to the increasing number of research investigations being conducted with ATP.

As a method of analysis, the ion-exchange technique of Cohn and Carter (*3*) was employed. In order to check this method by a completely independent technique, a comparison with the moving boundary (electrophoresis) procedure of Bock and Alberty (*4*) was conducted. Both methods were found to agree to within ± 5%, the resin method tending to give slightly lower ATP values.

Samples of disodium and dibarium ATP were stored at 25° C, 4° C and − 20° C, and assayed for ATP content after various periods of time. At 25° C, a progressive decrease in ATP content, amounting to about 3% per month for both salts, was noted. This decomposition was found to be associated with the development of ADP, AMP, and inorganic orthophosphate (pyrophosphate was not investigated). At both 4° C and − 20° C, however, no significant changes in ATP content could be detected.

From the data thus far obtained, it is concluded that disodium and dibarium ATP are stable at temperatures of 4° C, or lower, but decompose at the rate of about 3% per month when stored at 25° C. There appears to be no difference in the stability of the disodium salt as compared with the dibarium salt. It is suggested that metallic salts of ATP be stored in a dry atmosphere at low temperature, under which conditions they appear to be perfectly stable.

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References

1. Bailey, K. *Biochem. J.*, **45**, 479 (1949).
2. Rowles, S., and Stocken, A. *Ibid.*, **47**, 489 (1950).
3. Cohn, W. E., and Carter, C. E. *J. Am. Chem. Soc.*, **72**, 4273 (1950).
4. Bock, R. M., and Alberty, R. A. *J. Biol. Chem.* (in press).

Book Reviews

Quantum Mechanics. Alfred Landé. New York: Pitman Pub., 1951. 307 pp. $5.50.

Perturbation Methods in the Quantum Mechanics of n-Electron Systems. E. M. Corson. New York: Hafner Pub., 1950. 308 pp. $11.00.

The development of quantum mechanics in the past half century has made it a firm foundation for the discussion of atomic, molecular, and even nuclear phenomena, whenever velocities can be regarded as small compared to the velocity of light and the constituent particles do not change in numbers. The frontiers of theoretical knowledge lie in the related problems of relativistic invariance, transformations of the ultimate particles, and the field theory of the forces between them. The practical application of the settled theory is limited by the complication of dealing with many body problems.

It is now customary to introduce students of physics to some quantum mechanics in their last undergraduate years and first graduate year, and several excellent textbooks for such courses are available. For an advanced course, however, it has, to a large extent, been necessary for the professor to bridge the gap between these elementary texts and the advanced monographs and original literature. The two books considered here seem to fill most of this gap very well.

Landé's book seeks to build up an approach to the understanding and solution of problems in the field from the physical picture. He adopts a historical arrangement, showing in his first 7 chapters how quantum mechanics develops from the equivalence of wave and particle descriptions—explaining approximate methods of solving the wave equation, and developing the technique of matrix mechanics in an intuitive manner. In the second half of the book he lays the groundwork for a large number of physical applications: elementary radiation theory, including photo-ionization and coherent and Raman scattering; atomic spectra, including the details of the helium spectrum and fine structure and Zeeman effect in general; molecular structure and molecular spectra, including the Heitler and London theory of the hydrogen molecule; an introduction to statistical methods, dealing with the Bose and Fermi gases and with fluctuations; the Dirac electron and relativity theory; the quantum theory of radiation; and the meson theory of nuclear forces. In all this the emphasis is on the physical picture behind the mathematical equations, which, in the frontier examples, we may hope will remain when the present mathematical difficulties have been overcome.

Corson's book will carry the student who already has an idea of the physical pictures involved over the whole range of exact and approximate mathematical solution of problems in the quantum mechanics of many particles. It is thus more advanced and more complete in itself, but a little more restricted in range than Landé's book. The author develops the general theory by the methods of Dirac, mathematically rigorous for problems involving discrete states, but assuming the natural extension to continuous spectra. Having so introduced Hermitian operators on vectors to describe observables and states in various representations, and the canonical equations of time change, he next deals with the application of group theory to give exact transformations for simplifying problems, and with perturbation theory in general. Then follow chapters on the methods of approximate solution: orbitals, variational methods, the Hartree-Fock equations, statistical fields, and the vector model for many-electron problems treated in detail by Dirac's methods, including applications to molecular structure. Finally, Corson deals with subjects at the frontier; second quantization and Heisenberg's *s*-matrix theory. To cover the material dealt with so well in this book would previously have required reading at least three monographs, as well as original literature.

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Stratigraphy and Sedimentation. W. C. Krumbein and L. L. Sloss. San Francisco: Freeman, 1951. 497 pp. $5.00.

It is truly remarkable that in spite of rapid advances and the immense practical importance of stratigraphy, no general textbook has heretofore covered this field since Grabau's *Principles of Stratigraphy* in 1913. It is equally noteworthy that the present volume could hardly have been written more than a decade ago, for its viewpoint and substance have been strongly molded by recent advances in which its authors have played an active part.

Although the purpose of the book is clearly to interpret the stratified rocks, almost half its pages are devoted to sedimentary petrology and sedimentation. This is quite proper, of course, for materials and processes must be understood before rocks can be interpreted. The attempt to cover so wide a range of subject matter in a single volume must have imposed many difficult choices, and perhaps no one will regret that the book is rather heavily weighted in the aspects of stratigraphy in which the Northwestern school has recently been so much engrossed.

Following a brief introduction, Chapter 2 reviews the history of the geologic column and of our system of classifying the stratigraphic record. Here the reader encounters two viewpoints, which run through the book and will be warmly approved. One is the awareness that stratigraphy is a young and growing science in which ideas are still in flux; the other is consciousness of the problems arising out of the practical application of stratigraphy to the search for petroleum—especially in subsurface exploration.

Chapter 3 describes stratigraphic procedures, and Chapters 4–7 deal with various aspects of sedimentary petrology and processes of sedimentation. Chapters 8 and 9, devoted to stratigraphic paleontology and sedimentary facies, respectively, form a necessary prelude to the discussion of the principles of correlation covered in Chapter 10.

Chapters 11 and 12 develop the idea that the nature of a sedimentary deposit is largely determined by the tectonic framework in which it is formed, as well as the stage in the tectonic cycle. These chapters, synthesizing recent advances in philosophical interpretation, are perhaps the most thought-provoking in the book.

It is, of course, inevitable that, in a completely new treatment of a field so broad and controversial, other specialists will question some of the terminology and some of the interpretations. Indeed, one of the most wholesome aspects of the book is the frequence with which its authors indicate a tolerance for other interpretations. This is not the place to debate such problems, but a sample may serve to illustrate their nature. In discussing the tectonic framework of sedimentation, *shelf areas* are defined (p. 338) as

> the most neutral or stable parts of the craton, lying between and among the more postive or negative areas. The term applies to a degree of tectonism, and not to specific geographic areas. Present continental margins are shelves, but, in a stratigraphic sense, the term refers to any portion of the craton which displays no marked tectonism during a major cycle of deposition.

A further distinction is made between the *stable shelf,* which is "the most neutral part of the craton," and the *unstable shelf,* which is characterized by "slight oscillatory movements" that "commonly give rise to cyclical sedimentation." In view of the long-standing and widespread use of the term "shelf" in a different geological sense, this usage can hardly avoid misunderstanding and confusion. Certainly, the continental shelf off California has not been stable during recent geologic time, and that along the Gulf Coast has been rapidly subsiding. Neither of these regions could be accepted as *shelf* in the stratigraphic sense. Furthermore, the idea of shelf seas lying over the continental shelf is so deeply ingrained in geologic literature that to speak of the Illinois coal fields as having formed on a shelf would be confusing.

It is difficult to accept the generalization (p. 210) that "in the deeper parts of the neritic environment, clastic sediments are usually subordinate," and that "limestone may occur in great variety." The modern neritic sea floors certainly are generally covered with terrigenous muds or sands, except for limited areas.

In the attempt to be brief yet circumspect, the authors seem, in places, to be thinking rather more of their professional colleagues than of the student. On page 1, for example, stratigraphy is defined as "the integrating science which combines data from all other branches of earth science in a form from which historical geology emerges as a natural product." Probably only a very alert student would quickly translate this to mean that stratigraphy is the study of strata! Close reasoning in technical jargon perhaps inevitably demands close concentration, as on page 384, where we read: "The sedimentary environment is of strongest importance in controlling the detailed patterns of sediment distribution." But it would be unfair and un-