The problems are attacked by the techniques of successive approximations and of expanding solutions in series of eigenfunctions that span the space of solutions to the reduced equation, when known.

The last chapter of each part is concerned with a discussion of what the author classifies as singular integral equations—that is, those in which the kernel, K, can be represented as $K(s,t) = \frac{A(s,t)}{|s-t|}$, where A is analytic.

The bibliography seems to contain a fairly extensive sample of Russian work on the applications of integral equations.

The author does a great service by bringing together in one volume more applications than are available in any other work, but this does mean that the problems cannot be intensely examined. Anyone who plans to use this book should have a knowledge of complex variables, and if he does not have a grounding in integral equations he should have at hand something like Courant and Hilbert's book.

Some things are puzzling. The author introduces the concepts of inner product and norm, and also operator, then uses them very sparingly. Furthermore he fails even to mention the powerful generalizations that can be made when one uses the Stieltjes integral.

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Crystal Dislocation

The Direct Observations of Dislocations. S. Amelinckx. Academic Press, New York, 1964. x + 487 pp. Illus. $17.

This book provides beautiful and ample evidence that all of the curious kinds of behavior devised by imaginative geometrical theorists before anyone ever "saw" a crystal dislocation do in fact exist. During the first 15 or 20 years after the dislocation theory was developed, a small group of theorists devoted themselves to exploring the geometrical configuration and the elastic stress fields of dislocations in various crystal structures. This first stage culminated in books that emphasized the theoretical developments [W. T. Read's *Dislocations in Crystals* (McGraw-Hill, 1953); A. H. Cottrell's *Dislocations and Plastic Flow in Crystals* (Oxford University Press, 1953); and J. Friedel's *Dislocations* (Gauthier-Villars, 1956, and Addison-Wesley, ed. 2, 1964)].

After the theory was developed experimental research workers began their attempts to find methods of observations that would give direct evidence concerning the behavior of dislocations. The extent of their success can be seen in this book in which a prominent scientist who has done much excellent work in the field describes many of the observations. The book is filled with many pictures that form a graphic record of the various ways in which dislocations reveal themselves. Amelinckx begins by describing crystal growth, the first phenomenon in which single dislocations or a few dislocations play a decisive role. Observations using low resolution are discussed first; they are made with an ordinary optical microscope. The author then describes evaporation methods using replicas which have recently become a high resolution method. He then discusses and considers the etch pit methods for ionic crystals, semiconductors, and metals and considers techniques for decorating the dislocations with impurities. Amelinckx himself has done excellent research in this area. The various x-ray methods are then described.

Most of the above discussion deals with low resolution research—that is, distances smaller than 5×10^{-5} centimeters are not usually resolved. That discussion precedes a very complete coverage of the research involving transmission electron microscopy where the resolution can be 15Å. The theory is examined, and the kinematical and the dynamical theory are given. Applications in which all of the strange things that dislocations do in thin films of pure metals, alloys, and ionic crystals are described and illustrated in beautiful pictures. Finally, direct resolution of crystal lattices and the moire patterns of two thin crystals are described, and the influence of dislocations in such experiments is shown.

On the whole, the emphasis is geometrical and descriptive, although quantitative calculations are given where they provide useful information and can be made. This emphasis on the geometrical and the descriptive is a valid reflection of the state of the art. Thus far only about 20 percent of the observations are quantitative. In the future, with much hard work, more accurate numerical measurements will be made.

This excellent book has been published at the right time. It is well worth the attention of anyone interested in dislocations.

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A World Stratigraphy

Les Temps Fossilifères. vol. 1, *Paléozoïque Inférieur*. Henri Termier and Geneviève Termier. Masson, Paris, 1964. vi + 689 pp. Illus. F. 270 ($54).

A well-known and widely used American text in a certain field of geology was condescendingly dismissed as a "masterful compilation," but one cannot thus slightingly refer to the genuinely masterful works we have come to expect from the Termiers. The present work, gorgeous in its scarlet and gold binding, weighing in at $8 per pound, and the two volumes yet to come will constitute the "Traité de Stratigraphie et de Paléogéographie" (the second volume, *Paléozoïque Supèrieur,* is in preparation), a work foreshadowed by the same authors' previously published books—*Evolution de la Lithosphère* (1956-1957), *Erosion et Sedimentation* (1960), *Paléontologie Stratigraphique* (1960–), and *Histoire Biologique de la Biosphère* (1952). The Termiers refer to the *Traité* as a more systematic and more detailed form of the last, a considerable understatement.

This volume can be compared to only one other work of this century—Haug's *Traité de Géologie* (II. *Les Périodes Géologiques*), published in 1911. For years the working geologist has kept Haug at his elbow so that he can turn to it first when searching for an entering wedge to the stratigraphy of practically any part of the world.

The plan of *Les Temps Fossilifères* is logical and easy to follow. After pointing out that this treatise is essentially for readers who are acquainted with the principles of stratigraphy, the Termiers content themselves with reviewing certain ideas about the relations of strata to each other and relevant questions: unconformity as indication of relative movements of land and sea; initiation of sedimentary cycles; paleontologic

zones to which they attribute the greatest importance (relieving the reader of the burgeoning mass "of learned technical terms which are practically never used"); the importance of paleogeography; the chronologic value of biozones; correlation which they emphasize is impossible without fossils; migrations and faunal provinces (wherein they introduce a number of elegant new terms such as *prochorèse, esbolie, cathistémèse, métachorèse*, and *allagie*, as if ecology and paleoecology were not already choking on their terminology); and the implications of paleomagnetism at which they look slightly askance and for the present leave as the offspring of *géophysiciens anglo-saxons*. The whole of these 13 pages constitutes an interesting and remarkably succinct statement of their stratigraphic faith. The reader is warned that he will not find any representations of actual cross sections, for they are considered as being only raw material, and it is deemed more rational to establish the vertical successions of beds restored to the horizontal and to present these in the form of tables (124 of them) of columns detailing the sequences in countries where they are best known or otherwise significant. This does not, however, allow any graphic presentation of phase and facies relationships which are so important in stratigraphic interpretation.

In dealing with what is after all a subjective problem—the delimitation of the geologic periods and their first order subdivisions—the authors are not iconoclastic. Their framework uses the familiar terminology, with Termierian variations. Thus, beginning with the earliest rocks of the Cambrian, each period is subdivided into what they consider natural, episodic units to each of which is assigned a roman numeral: Cambrian I (Eocambrian), Cambrian II, and so on, through Cambrian VIII. They attempt to resolve the position of the Tremadocian by calling it Tremadoc IX. The Ordovician continues the succession from X to XIII, the late Silurian-early Devonian is Siluronian XVI, the latest Devonian-earliest Mississippian is Strunian XXII, the latest Paleozoic is Permian XXVIII; presumably the Mesozoic and Cenozoic will continue this numeration. This first volume terminates with the Siluronian XVI. Each unit or epoch is the subject of a chapter in which the authors give a brief historical analysis and present what is known of absolute age determinations, tables of sequences with commentary, earth movements, petrogenesis, sedimentation, climates, paleogeography, and organic developments, and provide an extensive bibliography of more recent papers (many through 1963). So far as is practical the major geographic areas are given equal treatment, but naturally the best-known are more extensively considered. Particularly notable are the analyses of the great Paleozoic sequences of the U.S.S.R. and northwest Africa. Unlike too many French treatises, this volume has an index, and a good one.

No work of this sort can possibly be wholly correct in detail, and the stratigrapher, when he turns to the treatment of his favorite strata, will surely find factual errors or inconsistencies and what he will consider to be misinterpretations. To mention a few, I find *Maclurea, Maclurites*, and *Maclurina* (all the same genus) in Ordovician X; the Manhattan Prong is said to be on the right bank of the Hudson; West Canada Creek is labelled "W. Hudson"; Monroe County, Pennsylvania, is said to be the type region of the Monroe Series; the Pittsford shale is far from Otisville, New York; the Helderbergian of New York is not given the discussion it merits, especially after the recent work of L. V. Rickard; the authors seem to accept without question Dombrowski's cultivation of bacteria from the Salina salt of New York, although one of his bacteria is identifiable as the commonest stray bacterium in laboratories; here and there one finds a reference in the text which is not cited in the bibliography; and, although I am admittedly ignorant of the refinements of sedimentological terminology, I could find no clue as to what the *aleurolites* of Cambrian V in the Ukraine might be (this is not in the index although "water-lime" is). But in view of the appalling nature of the task, these are trifles, and the authors are to be congratulated on their achievement.

It is lamentable that this great and highly useful work is so expensive—true, 35 years ago Haug seemed so at $10—that few of those who should possess it, graduate students especially, will be able to afford this volume, as well as the future volumes in the series, unless some foundation should award copies in the agreeable fashion of the prize books of the past.

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Geometry and Calculus

Analysis. vol. 1. Einar Hille. Blaisdell (Ginn), New York, 1964. xiv + 626 pp. Illus. $10.

This book is an analytic geometry plus calculus text which contains far less differentiation and integration drill than the standard texts and practically none of the time-honored engineering applications. It is a mathematics text instead of the usual engineering training text. The book is intended for "college students who have developed aptitude and maturity in mathematical reasoning," and for "honors students and future mathematics majors." The first volume covers plane analytic geometry, differentiation and integration of functions of a single variable, infinite series, and plane curves. Functions of severable variables and related topics are left to the second volume. Although there are many exercises, the book is definitely not a drill text.

The treatment of each topic is rigorous. Limit operations are developed through uniform convergence. Real variable theory is developed through an introduction to functions of bounded variation and their relation to curve rectifiability. Complex analysis is treated in enough detail to enable the author to prove the fundamental theorem of algebra and to give a good discussion of partial fraction expansion of rational functions. Although analytic geometry is severely pruned, the discussion of the geometry of plane curves is carried unusually far. An attractive feature of the book is its historical remarks. Whenever a topic is introduced, even one so specialized as an inequality, associated names, dates, and sometimes background comments are given.

Hille's book is more difficult for a student than a classical drill text, but in a few places the book is more difficult because it lacks the sophistication one would expect. In a book in which rectifiability is discussed one need not confuse the reader by repeating the old chestnut that "a straight line is the shortest distance between two points" (p. 389). A straight line is a geometric configuration, not a distance. In a book in which details about functions and their domains are discussed one expects less confusion than usual about sin x. Is x here a geometric configuration [an angle or a circular arc (see p. 389)] or a number? In the first case the sine function