

Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (M. M. Woolfson, Physics Department, University of York, Heslington, York YO1 5DD, England). As far as practicable books will be reviewed in a country different from that of publication.

Handbook of Geochemistry. Vols. I and II/1. Executive editor K. H. WEDEPOHL. Vol. I, pp. xv + 442, 60 figs., 4to, cloth bound. Vol. II/1, pp. x + 586, 172 figs., 4to, loose-leaf binder. New York: Springer-Verlag, 1969. Price of the two volumes boxed (not sold separately) DM 224.00, U.S.\$56.00. Subscription price for purchasers of complete *Handbook* DM 179.29, U.S.\$44.80.

Handbook of Geochemistry est appelé à jouer un rôle très important, surtout par son volume II, dans la diffusion des connaissances acquises actuellement dans cette discipline.

Depuis Rankama & Sahama (1950) et V. M. Goldschmidt, édité après sa mort par A. Muir en 1954, le point n'avait pas été fait quant à l'ensemble des résultats géochimiques pour les éléments classés par ordre croissant de leur nombre atomique. Etant donné le nombre toujours grandissant des publications scientifiques, il n'est plus possible à un ou deux auteurs de réaliser le recensement et la synthèse des travaux réalisés à ce jour dans le domaine de la Géochimie. C'est pourquoi 70 auteurs environ ont été appelés à contribuer à ce travail de compilation, chaque élément chimique étant traité séparément par un ou plusieurs spécialistes. Il est certain que cette manière de procéder offre toutes garanties quant au caractère exhaustif que doit avoir un tel travail, tant pour les résultats géochimiques que pour les références bibliographiques. Les chapitres du volume II sont numérotés suivant les nombres atomiques des éléments et chacun de ces chapitres comprend les sections suivantes:

- A Crystal chemistry.
- B Isotopes in nature.
- C Abundance in cosmos, meteorites and tektites.
- D Abundance in rock-forming minerals (phase equilibria), minerals.
- E Abundance in common igneous rock types.
- F Behavior in magmatogenic processes (pegmatites, gas transport, ore deposition, etc.)
- G Behavior during weathering and alteration of rocks.
- H Solubilities of compounds which control concentrations of the element in natural waters; adsorption processes; valence states in natural environments.
- I Abundance in natural waters and in the atmosphere.
- K Abundance in common sediments and sedimentary rock types.
- L Biogeochemistry.
- M Abundance in common metamorphic rock types.
- N Behavior in metamorphic reactions.
- O Relations to other elements, economic importance, etc.

Le volume I comprend principalement de la cristallographie (J. Zemann), de la thermodynamique (K. B. Krauskopf). Il traite de la composition des météorites (K. Keil); des abondances cosmiques (G. G. Goles); des aspects géophysiques de la structure et de la composition de la terre et de l'écorce terrestre (U. Schmucker); de la composition

et de l'abondance des roches ignées (K. H. Wedepohl), des roches sédimentaires (K. H. Wedepohl), des roches métamorphiques (K. R. Mehnert); des océans, fleuves et de l'atmosphère (K. K. Turekian), de l'estimation des résultats avec des éléments de statistiques appliquées à la géochimie (D. M. Shaw). Il est dommage qu'à côté de ces chapitres brillamment traités par les meilleurs spécialistes mondiaux, le volume I ne comprenne pas des notions de chimie physique des solutions d'électrolytes appliquée à la géochimie comme dans le livre *Solutions, Minerals, and Equilibria* de R. M. Garrels et C. L. Christ.

L'importance scientifique de ce livre est évidente: depuis une vingtaine d'années rien d'aussi complet n'avait été fait dans le domaine de la géochimie. Ce livre est indispensable à tous les géochimistes et est également très utile aux cristallographes, minéralogistes, géologues et à tous les scientifiques qui s'occupent des sciences de la terre.

H. MARTIN
J. MOREAU

*Institut Géologique
Université de Louvain
Sint-Michielsstraat 6
Leuven
Belgique*

An introduction to rock forming minerals. By W. A. DEER, R. A. HOWIE and J. ZUSSMAN. Pp. x + 528. London: Longmans, 1969. Price (hard covers) 70s, (paper back) 45s. Also volumes I-V as follows: **Vol. I. Ortho and ring silicates**, pp. ix + 333. **Vol. II. Chain silicates**, pp. ix + 379. **Vol. III. Sheet silicates**, pp. vi + 270. **Vol. IV. Framework silicates**, pp. ix + 435. **Vol. V. Non-silicates**, pp. ix + 371. Price of each volume 105s.

In 1962 Deer, Howie and Zussman produced the five volumes of *Rock-forming Minerals*. The books attracted considerable attention and were well received; they were sold out quickly despite annual reprinting. The books were translated into Russian and were widely distributed in the Soviet Union. This is quite natural, since the work contains unique summarized data on almost all rock-forming minerals, as well as a detailed characterization of their most important features that are of interest for petrologists, mineralogists, crystallographers and many other specialists. Especially essential however, is the fact that, written at the end of the fifties, the book was based on crystal-structure data and presented a new understanding of individual minerals, their interrelations, classifications, genesis and limits of thermodynamic stability following from these data as well as from the works on synthesis and other experimental investigations. Also such classical data as chemical composition and optical properties of minerals were re-interpreted and elucidated in the light of current knowledge.

As to the practical aspects, the work by the three authors was done at a very high level. First of all the rational construction and distribution of the material among the five volumes should be mentioned. The first four volumes are quite reasonably devoted to silicates; volume I to ortho, diortho and ring silicates; volume II to chain and belt silicates; volume III to sheet silicates; volume IV to framework silicates. The fifth volume includes all the material concerning oxides, sulphides, sulphates, carbonates, phosphates and other non-silicate minerals.

A valuable supplement to the five main volumes are the two editions of the one-volume *Introduction* that were published after 1966, giving a short description of the most essential data on the main rock-forming minerals.

The description of each mineral, or a group of minerals, is presented according to a universal plan: crystallography, structure, chemical, optical and physical properties, distinguishing features and paragenesis. Information on all these subjects, especially chemistry, optics and paragenesis, is quite fundamental and summarizes all that had been done over a long period of time.

Naturally, these subjects, which deal with the structures of minerals, are of great interest for petrologists and mineralogists. This is, first of all, connected with the fact that the five volumes consist of material that was scattered in numerous articles, often published in non-geological literature. Secondly, the authors, where possible, discuss in detail the dependence of various physical properties on structural peculiarities of the minerals. Finally, there are very valuable summarized data on the use of X-rays for the determination of mineral composition.

In the chapters devoted to the chemical constitution of minerals there is detailed information on the composition variability limits; particular chemical analyses of most representative samples and corresponding structural formulae are given; in some cases the authors discuss the relation between the composition, physical properties of minerals and paragenesis. In the same chapters data on syntheses and thermodynamic stability of minerals and the phase equilibria diagrams are presented. This material completely reflects the rapid progress which, of late, has been taking place in the experimental modelling of natural processes. The description of optical and physical properties of minerals, and their dependence on chemical composition and peculiarities of crystal structures, is accompanied by a great number of various 'composition-properties' diagrams, that give a simple means of identifying minerals.

The description of minerals is completed by a characterization of rocks containing these minerals, and their geological associations; problems of mineral genesis are considered in the light of the available experimental data.

The compositional structure of the five volumes, both in content and form, has been done by the authors extremely well. They have succeeded not only in systematically summing up the knowledge accumulated in studying one or another mineral, but also in critically analysing and coordinating the diverse data available, based on the establishment of interrelations between structure, composition, properties and conditions of mineral formation. The comprehensive information contained in the five volumes will evidently promote a more profound understanding, as was the authors' objective, of the nature and properties of minerals in general.

At the same time it should be mentioned that the quality of the crystal-structure data is not the same for all minerals

considered. Structural studies have quite a short history and the structural information can only reflect that state of knowledge which was reached at the time the work was written. Even now, nearly ten years later, the situation remains in general the same, because structural investigation is often very complicated (sometimes impossible) and may only sometimes be accomplished.

Naturally the work *Rock-forming Minerals* was in perfect correspondence with the state of knowledge in the period 1960-62. It should be remembered, however, that since then an intense development of structural studies of minerals has taken place. New, important data have been obtained and our understanding of the relationships between structure, composition and conditions of mineral formation has considerably advanced. At present the contents of the five volumes is falling more and more behind the contemporary state of knowledge of structural and genetic mineralogy. Under these circumstances, the regular annual reprinting of *Rock-forming Minerals* does not seem to be justified. It has now become urgently necessary to have a revised and supplemented edition of the work.

It is impossible to list in this brief review all the new data that could supplement the contents of the five volumes. It is sufficient to give just a few examples. Thus, in recent years, essentially new and more perfect and exact data have been obtained for olivines, norbergite, sapphirine, staurolite, cordierite, osumilite (volume I), rhodonite, glaucophane, wollastonite, walstromite (volume II), α -quartz, bytownite, low and high albite, sanidine, orthoclase, maximum and intermediate microcline, anorthite, heulandite (volume IV). Concepts on pyrophyllite, serpentines, stilpnomelane, halloysite, nacrite, have been essentially changed. New structural data, in particular, were actually obtained by one of the authors of this work and their inclusion should therefore be easily realized.

It should be mentioned that in the five volumes the structures are presented mainly in the form described initially by the authors who studied them. Perhaps, this was justified when the material for the book was first being collected. The situation is quite different now and it is necessary to revise the material. There is also the possibility (when re-editing the five volume work) of using the most visually effective forms of description of crystal structures, notably - structural polyhedra. The constructive initiative of the authors themselves can be displayed here, as well as the results of the great work in this respect carried out by N. V. Belov in his work *Crystal Chemistry of Silicates with Large Cations* and practically in every issue of *Mineralogical Proceedings* of the Lvov Geological Society.

Very important experimental studies have been carried out during recent years; these are very essential for understanding the nature and interrelations of minerals, their limits of stability and positions on the phase diagrams of state, variations of chemical composition, etc. On the other hand, broad crystallochemical generalizations have been made, and many structural principles for groups of minerals have been established. As examples, the papers by Radoslovich, by Bailey on layer silicates, by N. V. Belov on the minerals of chapter II of *Crystal Chemistry of Silicates* may be cited. The valuable scientific material of these works is worthy of inclusion in a new edition.

At present, of increasing importance for determining the properties and identification of minerals are such methods as infrared spectroscopy, differential thermal analyses, electron spin resonance, nuclear magnetic resonance and elec-

tron microscopy. The data obtained by these methods for some minerals are of a decisive importance as diagnostic features (for instance, the data of electron microscopy and selected area diffraction for halloysites and serpentines). Unfortunately, these methods and their role have not found due attention in the five volumes, and they might take a worthy place in future editions.

The X-ray method is of the most importance for the identification of minerals. It has become necessary not only for specialist researchers but in fact for all petrologists and mineralogists as well. Therefore it would be expedient to provide the work *Rock-forming Minerals* with tables of X-ray powder diagrams, either including them in the text or in an addendum at the end of each volume.

In conclusion, we should like to emphasize once more the great scientific and practical value of *Rock-forming Minerals* and the desirability of its reissue in an updated and perfected version.

*Institute of Geology
Academy of Sciences USSR
Pyzhevsky 7
Moscow
USSR*

B. B. ZVYAGIN
V. A. DRITS

X-ray diffraction methods in polymer science. By LEROY E. ALEXANDER. Pp. xv + 582. New York: JOHN WILEY, 1970. Price 265s.

This monograph is a most valuable compilation of material which, up to now, has been scattered through a wide range of journals such as *J. Polymer Sci.*, *Kolloid-Z.*, *Phil. Mag.*, *Helv. Chim. Acta*, *Makromol. Chem.*, *Nuovo Cimento*, *Acta Cryst.*, *Nippon Kagaku Zasshi*, etc., etc. Among other purely factual items are almost five hundred references to specific papers in the text and a further five hundred references to papers from which the thirty-six pages of crystallographic data for about 270 polymers have been derived. Numerous general references are also included.

The introductory chapter discusses first the basic concepts associated with crystallization in polymers and with

X-ray scattering in general; then follow more detailed discussions of both wide-angle and small-angle scattering by polymers. Chapter 2 deals with instrumentation and includes treatment of the problems of specimen preparation and mounting, comparative discussions of diffractometer and photographic methods, and a section on optical diffractometer techniques for interpretation. Chapters 3 and 4 discuss the fascinating and controversial subject of degree of crystallinity in polymers and preferred orientation respectively. The remaining chapters deal with the possibilities of obtaining information on macro-structure from low-angle scattering, relationships between micro-structure and wide-angle scattering and finally a shorter treatment of the problems of lattice distortion and of crystallite size. The book is written for research workers in two main categories – those engaged in polymer studies who want to understand the contribution that X-ray diffraction can make and those engaged in X-ray diffraction studies who wish to widen their experience of their application in materials science.

It is difficult to know where to begin in commenting on such a large and comprehensive book but, as an X-ray crystallographer relatively recently entering the field of polymers, I found the chapter on the degree of crystallinity and the two on macro and micro-structures perhaps the most valuable. The presentation is highly concentrated but extremely clear and will save newcomers to the field enormous amounts of time in hunting through the literature. The author manages to mix purely technical and experimental details with discussions of the background theory and even detailed, step-by-step instructions for carrying out analyses of resulting data.

This book would earn its place on the library shelf purely for the factual material which has already been mentioned at the beginning of this review, but its place in the laboratory and on the desk is also fully justified by the clarity and completeness of the exposition and the sense of perspective and balance that it brings to its subject.

C. A. TAYLOR

*Department of Physics
University College
P. O. Box 78
Cardiff CF1 1XL
Wales*