

BOOK REVIEWS

THE TECTONICS OF THE CANADIAN SHIELD, J. S. STEVENSON, EDITOR (Royal Society of Canada "Special Publications" Series, No. 4.) University of Toronto Press, 196 pages, 1962. \$6.50.

The appearance of a 4th issue of the Special Publications series of the Royal Society of Canada is welcome, for this is one of the few methods by which the progress of geology in Canada may be reviewed from time to time. The book is a collection of 15 papers presented as a symposium during the annual meeting of Section IV in 1961.

Periodic stocktaking is necessary because of the striking advances in our knowledge of the Precambrian of Canada in recent years. The symposium is a constructive effort in this regard. The contributors are drawn from industry, from provincial and federal bodies, and from universities across Canada, and the coverage of the Canadian Shield is comprehensive. With Stevenson's editing, the book begins by reviewing the present status of the tectonic map of Canada and the structural provinces of the Shield. In the ensuing papers attention is focussed on areas from west to east, from Yellowknife to New Quebec. The next section deals with post-Precambrian events, first as they concern the exposed Precambrian, and secondly those influenced by structures in the basement underlying the sedimentary basins to the west. The concluding paper, by J. T. Wilson, although not dealing specifically with the Shield itself, is nonetheless appropriate, for it examines recent developments in orogenic theory as a whole, in the light of which our knowledge of the continental cores must continually be reexamined.

The first paper, by Stockwell, sets the scene for what follows. The broad subdivisions of the Canadian Shield, based on structural trends and potassium-argon age determinations, have been published previously and there is now substantial acceptance of them. They are:

<i>Time Units</i>	<i>Orogeny</i>	<i>K-Ar age (m.y.)</i>	<i>Related Provinces</i>
Upper Proterozoic	Grenville	950±150	Grenville
Middle Proterozoic	Hudsonian	1700±150	Churchill, Bear, Penokean
Lower Proterozoic	Kenoran	2500±150	Superior, Slave
Archean			

The important distinction between the K-Ar age that presumably dates the last "thermal event" affecting a region, and the age of formation of

the rocks themselves, is emphasized throughout this and other papers. Each structural province can be divided into four main parts: (1) older rocks known to be refolded or recycled by a later orogeny, (2) rocks deformed by the orogeny, (3) plutonic rocks formed during the orogeny, and (4) cratonic cover rocks. These divisions are investigated in a more detailed way by Burwash and Baadsgaard who deal with the age relations of the Nonacho Series in the Churchill Province. They demonstrate the presence of a pre-Kenoran basement complex reinvolved in the Hudsonian cycle of metamorphism. In another paper, Godfrey and Baadsgaard have evidence for older basement rocks in NE Alberta, but here the arguments are geological, as the latest orogeny (Hudsonian) "reset the clock" throughout the area to give uniform K-Ar ages between 1740 and 1830 m.y.

The junction between structural provinces of different minimum ages are of special interest. H. D. B. Wilson and Brisbin describe a gneiss zone bounded on its northwest side by a fault zone associated with ultrabasic rocks and a gravity low that separates the Churchill Province from the older Superior Province to the south in Manitoba. They emphasize the similarity between this boundary zone and an island arc system and contrast the structural features on either side of it. Statistical studies of structural attitudes and rock distributions in each area are presented, but are as yet based on scanty data.

The part of the Superior Province east of Hudson Bay and west of the Labrador geosyncline is termed the Ungava stable area by Bergeron, Bérard, and Gélinas in a paper discussing the sedimentary/volcanic basins bordering this nucleus. These are divided into the Labrador Geosyncline, the Mistassini-Otish Basins, the Belcher Basin, and the Cape Smith-Wakeham Bay Basin, and a valuable summary of the geology of these important areas, about which little has as yet been published, is presented.

The economic implications of structure and tectonics are never far away and have also received attention. Lang has reviewed the progress of the Geological Survey's experiments with metallogenic maps in the study of the relation of mineral occurrences to environment. Parkinson has reported on Operation Overthrust, a comprehensive airphoto and geological compilation of the whole of the southern Shield. Several major features have become evident in this study, notably four principal NE fault zones in the Superior Province: the Nipigon, Michipicoten, Eastmain, and Chibougamau. A similar type of study in Saskatchewan by Byers classifies the major faults in two regions north and south of Lake Athabaska. A consistent pattern of major shears is defined, each parallel set having the same type of displacement. The paper effects a broad synthesis and is accompanied by a comprehensive reference list.

A complete reappraisal of the classical geological area between Blind River and Lake Timagami is presented by Thomson. The edge of the Huronian basin of sedimentation is defined by occurrences of uraniferous conglomerate above an unconformity. With this interpretation the extent of the Huronian Series is much restricted and the lithologically similar rocks at Sudbury are assigned a pre-Huronian age. It is evident that the areas studied for the longest periods and in the greatest detail in the Shield are also the most complicated, but one can only hope that this correlation is accidental. The Grenville Province, likewise a long studied and increasingly complex unit, is reviewed by Hewitt in Ontario and by Osborne and Morin in Quebec. Hewitt contrasts the catazonal character of the French River area with the mesozonal nature of the structures in the Hastings Basin. This double division of the Grenville Province is also evident in Quebec, the line of demarcation being termed the "Green-rock line" by Osborne and Morin. Southeast of this boundary lies the Grenville A Subprovince characterized by a recognizable metasedimentary sequence associated with anorthosites and charnockites, north-south structural trends, and granulite facies metamorphism. The Grenville B Subprovince northwest of the green-rock line possesses a more monotonous granitic lithology in amphibolite facies and evidence of superimposed deformations. Here it is difficult to identify rocks belonging to a Grenville geosyncline if indeed they ever existed.

The Precambrian Shield is brought up to date, so to speak, in papers by Douglas and Duffell, and by Sproule which examine post-Precambrian epeirogenic movements. In particular, Sproule has explored the role that Precambrian basement relief has played in the deposition and deformation of overlying post-Precambrian cover, and the manner in which resistant units that are expressed as topographic highs in the basement are in effect propagated upward by the deposition of competent clastic sediments and reef limestones around them.

In recent years the trend has been to favour a lithological terminology (e.g. Temiscamingue-type, Keewatin-type) in place of the long range age correlations proposed in earlier times, but with the advent of age determinations in large numbers the pendulum has one more swung the other way, and a preoccupation with age relationships and time sequences is very apparent in this symposium. The papers have collected a large body of data, much of it presented or assembled for the first time, and the list of references to published and unpublished work is of great value. This is one important objective of any symposium. The other important objective, however, appears to have been missed, for the reader is left to make his own synthesis of a group of only loosely related papers. There is no published discussion by the symposium participants, so that

the expected exchange and correlation of ideas is lacking. For example, there is no unanimity in the terminology applied to the structural provinces themselves, that north of Great Slave Lake being designated the Slave in one place and the Yellowknife in another. Osborne and Morin use Keewatin, Temiscamingue, or both in place of the term Superior offered by Stockwell and others. Ungava and Labrador Provinces, structural units not employed elsewhere, are introduced by Bergeron *et al.*, and there are inconsistencies in the use of Province and Subprovince in defining broad units. These are minor deficiencies, however, and the symposium is a valuable addition to the Canadian geological literature and will provide a reference point for the vast amount of work still to be done.

H. R. WYNNE-EDWARDS

JOURNAL OF THE GEOLOGICAL SOCIETY OF INDIA

The *Geological Society of India* was formally founded on January 23, 1959 as an All-India institution devoted to promoting in the most effective manner the cause of advanced study and research in all branches of Geology, with special reference to India. One of the main activities of the Society is the Publication of a *Journal*. Volume 1 of the *Journal* was published in 1959. Volume 2 appeared in 1961. In volume 2 the Annual Subscription is stated as 15 rupees (25 shillings (U.K.) or 4 dollars (U.S.)). The contents of volumes 1 and 2 are given below:

Volume 1

Geological Society of India. By L. RAMA RAO.....	1
Importance of geological studies in the future development of India, inaugural speech. By K. D. MALAVIYA.....	3
Evolution of the desert belt of Asia. Presidential Address. By D. N. WADIA.....	6
The great Vindhyan Basin of Northern India. By M. S. KRISHNAN and J. SWAMINATH.....	10
Soda metasomatism in the East-Shasta copper-zinc District, Northern California, U.S.A. By J. P. ALBERS.....	31
The source of the Deccan Trap flows. By W. D. WEST.....	44
Tertiary stratigraphic correlation in the Indo-Pacific region and Australia. By M. F. GLAESSNER.....	53
The significance of clouded plagioclase in the basic dykes of Mysore State, India. By C. S. PICHAMUTHU.....	68
Cross-folding and an echelon folding in Precambrian rocks of India and their relation to metallogenesis. By S. NARAYANASWAMI.....	80
Pebble fabric analysis of the Talchir boulder bed in the Jharia coalfield, Bihar. By P. N. GANJU and V. K. SRIVASTAVA.....	105
Additional microfossils from the Umaria marine bed, Central India. By S. B. BHATIA.....	116
Charnockite-quartzite association in the Rangala-Madulkele area, Ceylon. By P. G. COORAY.....	126
Ultrasonic velocities in some metamorphic rocks. By S. BALAKRISHNA.....	136

Quartz-dolerite dykes from Shirahatti area, Dharwar District, Mysore State. By C. NARASIMHA MURTHY, C. NAGANNA, and M. S. SADASHIVAIAH.....	144
Piania niniyurensis, a new Dasycladaceous Alga from the Niniyur group (Danian) of the Trichinopoly Cretaceous, South India. By S. SAMBE GOWDA.....	152
Smaller foraminifera from the Subathu Beds (Eocene) near Dharampur, Simla Hills. By N. K. MANDWAL.....	156

Volume 2

Guiding principles in stratigraphy. By HUBERT G. SCHENCK.....	1
Radioactivity of some rock types of Andhra State, India. By C. MAHADEVAN, V. V. S. S. TILAK and U. ASWATHANARAYANA.....	11
Nickel ore in Tagaung Taung, Upper Burma. By ANTE FERENCIC.....	23
The "Champion Gneiss" in the archaean complex of Mysore, Southern India—A Review. By B. RAMA RAO.....	31
A note on the petrology of apatite-biotite-monchiquite from Giridih coalfield, Bihar. By N. V. R. SUBRAHMANYAM and K. R. RAGHU NANDAN.....	39
Transformation of peninsular gneiss into charnockite in Mysore State, India. By C. S. PICHAMUTHU.....	46
Operator variation in the estimation of percentage heavy minerals. By C. GUNDU RAO.....	50
Petrology of the lavas of Pavagad Hill, Gujarat. By S. C. CHATTERJEE.....	61
The calc zone of Pithoragarh, with special reference to the occurrence of stromatolites. By R. C. MISRA and K. S. VALDIYA.....	78
Ampangabeite from Hazaribagh District, Bihar, India. By Y. N. RAMA RAO.....	91
Chromian antigorite from the chromite deposit near Byrapur, Mysore State, India. By S. VARADARAJAN.....	98

Enquiries regarding the *Journal* should be sent to Prof. L. Rama Rao, Editor, "Shantiniketan," Basavangudi, Bangalore 4, India.

CLAY SCIENCE

The Clay Research Group of Japan was formed in December 1958, at the National Institute of Agricultural Sciences, Tokyo. "Clay Science" is being published as one of the activities of the group. Through the publications the Group desires to co-operate with clay scientists throughout the world in discussion and mutual assistance for current researches. Volume 1 parts 1-2 and 3-4 were published in 1960. Membership fee for the Clay Research Group is \$2.00 per year, subscription to Clay Science is \$1.00 per year. The table of contents for the first publication follows:

Volume 1, No. 1-2

Quantitative estimation of montmorillonite in uranium deposits, Tottori Prefecture. K. YOSHIKAWA and T. SUDO.....	1
Problems of rapid clay mineralogical analysis of sedimentary rocks. K. OINUMA and K. KOBAYASHI.....	8
Quantitative estimation of hydrated halloysite in volcanic ash beds. S. KURAHAYASHI and T. TSUCHIYA.....	15
Procedure of clay mineral analysis. K. OINUMA, K. KOBAYASHI, and T. SUDO....	23
Acidic property and ion exchange in allophane. K. IIMURA.....	28

On the surface acidity of allophane and a coloration of vitamin A with the clay. D. YAMAMOTO.....	32
Reviews and abstracts.....	37
News.....	43

Enquiries regarding membership or subscriptions should be directed to: Secretary General, Clay Research Group of Japan, National Institute of Agricultural Sciences, Nishigahara-machi, Kita-ku, Tokyo, Japan.

ON THE EXTERNAL CHARACTERS OF MINERALS by A. G. WERNER, translated by A. V. CAROZZI, University of Illinois Press, Urbana 1962, xxxi + 118 pages, \$4.50.

This is a new and critically annotated translation of the first modern textbook of descriptive mineralogy: Werner's, *Von den äusserlichen Kennzeichen der Fossilien*, published in 1774. The translation was prepared from Werner's personal copy of the original German edition which included numerous corrections in the margins and on intercalated blank pages. The corrections appear to have been made over a considerable period of time since some of them were not included in earlier translations by de Morveau (1790) and Weaver (1805). This translation incorporates all of the handwritten changes and thus approximates what would have been a second edition of the book had Werner succeeded in preparing it for printing. The book is very well prepared with the original section numbers retained, and many footnotes commenting on unusual words and giving references to other early works.

The book is highly recommended to those interested in the history of mineralogy and also to those interested in the writings of one of the most controversial geological investigators of the eighteenth century.

MINERALS IN THE INFRARED, A CRITICAL BIBLIOGRAPHY by R. J. P. LYON, Stanford Research Institute, Menlo Park, California. 1962, vii & 76 pages, 8½ × 11 offset printing, paper covers \$1.00.

This valuable bibliography lists 440 published works with original reference and the Chemical Abstract reference. They are listed alphabetically by author (29 pages) indexed by subject, including mineral names (37 pages) and by author (8 pages). The indexes were prepared by reference to the abstracts as well as to the titles. The bibliography is highly recommended for all researchers interested in infra-red studies.

L. G. BERRY

DETRITAL HEAVY MINERALS IN NATURAL ACCUMULATES,
BY GEORGE BAKER, The Australasian Institute of Mining and
Metallurgy, Osborne House, 399 Little Collins Street, Melbourne,
Victoria, Australia, 1962. £2.2.0 (plus 4/5d. registered book postage).

This book, published as Monograph Series No. 1 by the Australasian Institute of Mining and Metallurgy has, as stated on the jacket and title page, "special reference to Australian occurrences." The author has had many years experience in the study of heavy mineral suites from many rock-types and from sands and concentrates of sands for various mining companies at the C.S.I.R.O. Mineragraphic Investigations Section.

The book begins with a brief discussion of the origin of detrital heavy minerals and their persistence and resistance. This is followed by a table giving the chemical composition, physical properties, and principal optical characteristics of most common and some uncommon detrital minerals. Curiously enough, barite and siderite are not included. The table is arranged in alphabetical order rather than according to properties, detracting from its usefulness in identifying the minerals. A fuller description of the principal diagnostic features for each mineral complements this table. A useful chapter on "complexities" (which make separation and identification more difficult) deals with inclusions, intergrowths, alteration, zoning, coatings, and, for no apparent reason in this context, trace and minor element content. Special properties, such as fluorescence, radioactivity, magnetic, and electrical properties each form the subject of a chapter. Source rocks for each of the common heavy minerals are listed, and examples are tabulated of typical associations in various Antipodal beach, fluvial, and surficial sediments. A brief final chapter is concerned with common contaminants of commercial concentrates. Two excellent coloured plates of heavy detrital minerals are included.

Although evidently primarily designed for use in Australia, the book has interest for all who are engaged in the study of heavy minerals. It is, however, no substitute for Milner.

W. W. MOORHOUSE