

Book Reviews

History and Role of Government Geological Surveys in Australia.

Edited by R. K. Johns; published by the South Australian Department of Mines. 111 pp, 1976.

Price: \$3, obtainable from the State, and Northern Territory, Geological Surveys; and BMR.

Today, Geological Surveys are a feature of government science and technology in practically every country in the world, and nowhere is the development of those surveys more closely tied to that of their country than in Australia.

Gold was the mainspring of Colonial Government action in the formation of the Geological Surveys, but their birth and growth in the various Colonies (States since Federation in 1901) have not been without trauma, as is neatly illustrated by R. K. Johns and his fellow contributors in this book.

The State Surveys, the Northern Territory Survey, and the Federal Bureau of Mineral Resources, Geology and Geophysics, each form the subject of a chapter. The history of each survey is covered, albeit very condensed, from its inception to the present day. Each chapter contains numerous snippets about the surveys and their personalities, and the whole is liberally sprinkled with photographs of the cast.

The first Survey, that of Victoria, was inaugurated in 1856, and the others followed as important new mineral discoveries were made or as the Colonial Governments acceded to public and economic pressures.

In the early days, great contributions were made by a few dedicated individuals, working within limited budgets and with little technical support. Of the more notable personalities mentioned in this book, A. R. C. Selwyn, who was to make such a great contribution to Australian geology both directly and indirectly through the geologists he trained, arrived in Victoria, from Great Britain in 1852, to be attached to the Surveyor General's Department at an annual salary of £500. Selwyn's classic clash of interests with the Secretary for Mines ended in 1869 with his resignation and the temporary disbanding of the Victorian Survey.

It is interesting to note that in 1910 the Victorian Government rewarded the Survey for its work in opening the Wonthaggi coalfield the previous year by building a Geological Museum.

The setting up of the New South Wales Geological Survey in 1875 was followed in the next year by the opening to the public of the Geological and Mining Museum, and, as a welcome example of government farsightedness, we are told that in 1879 the Government purchased the private collection of the Reverend W. B. Clarke, "The Father of Australian Geology".

In 1879 R. Logan Jack became Government Geologist for Queensland, which

position he held for 22 years. Between 1879 and 1880 he 'undertook a traverse of Cape York Peninsula from south to north, undergoing the rigors and dangers of travel in unknown country during the wet season, and facing the hostility of aboriginal inhabitants. During a surprise night attack on the camp he was speared through the neck. In spite of a painful wound he completed the trip to Somerset, meticulously mapping the geology, topography and river system'.

For the first year of the South Australian Geological Department set up in 1882 under the Commissioner of Crown Lands and Immigration, £1300 was voted for expenditure. The value of mineral production for that year is recorded as £460 000. The man appointed to the new position of Government Geologist was H. Y. L. Brown, a Canadian, and student at the Royal School of Mines in London. He came to South Australia in 1882 and worked there practically unaided until he retired in 1912. His achievements as an explorer-geologist have become legendary and it has been said of him that 'no single geologist has made such extensive personal contributions to the growth of our knowledge of Australian geology'.

It was H. Y. L. Brown who, as Government Geologist for Western Australia from 1870 to 1872, said 'The colony is extraordinarily rich in lead, silver, copper, iron, plumbago and many other minerals . . .' and who recommended several areas for gold prospecting, some of which ultimately proved to be auriferous.

In 1896 Gibb Maitland became Government Geologist for Western Australia and it is he who is responsible for surely the most delightful anecdote in this book; that which relates his employment of the notorious bushranger, 'Captain Starlight', who, having presumably retired from his illegal activities and using the name Major Pelly, established a reputation as a reserved and courteous civil servant, whose services to the Geological Survey were held in high regard by Maitland.

Survey activity throughout Australia has always been closely connected with the Mining Industry and, therefore, with the state of the economy. Intense mining activity has in the past engendered intense Survey activity, although in the mineral boom of the late 1960s many Survey staff were lost to the private sector, drawn by lucrative offers in the fight for geological expertise.

Meanwhile new horizons are opening. Environmental geology and the geology of the continental margin are just two of the new interests of the Geological Surveys. One enormous and vital task can be undertaken only by Geological Surveys—the assessment of the nation's total mineral resources, without which government economic policy moves in a partial vacuum. The realization of this has been slow. This book should ensure that the efforts of many of those who have participated in this realization or who have helped others attain it will not go unrecorded.

Those who are interested in the history of the Government Surveys in the broader

context of Australian Geological Sciences as a whole will find Branagan & Townley (1976) a good complement to this book.

Branagan, D. F., & Townley, K. A., 1976—The Geological Sciences in Australia—a brief historical review. *Earth Science Reviews*, 12, 323-346.

I. M. Hodgson

Walter, M. R. (Editor), 1976—**Stromatolites.** Developments in Sedimentology, 20, 771 + 18 pp, Elsevier, Amsterdam.

Price: Dfl259; in Australian approximately \$91

The book is concerned with a study of all aspects of stromatolites. Following the introduction, the second chapter describes field and laboratory techniques, including biological techniques, and discusses methods of classification. It seems likely that more will be heard of the computer-based qualitative image-analysis methods of classification. Abiogenic structures—calcretes, cave deposits, and geysers—that may mimic the form of stromatolites, are described in the following chapter; it seems an early stage to do so. Thereafter biology is introduced in several contributions that describe extant stromatolite-building organisms, discuss their evolution, and review their organic geochemistry. The chapter emphasizes most clearly, through microbiology and geochemistry, today's multidisciplinary approach to the field.

Chapter 5 is given over to fabric and microstructure; of particular value is a lengthy treatment of the origin and development of cryptalgal fabrics. It is the Editor's belief that the study of stromatolites is essentially one of morphogenesis, the subject of the next chapter. Hamelin Pool at Shark Bay remains the most diverse assemblage of modern stromatolites, and a condensed version of morphogenesis from there is of value. So too is the discussion of the factors controlling the morphology of Riphean stromatolites from Russia, considered to depend both on taxonomic composition and environment.

The use of stromatolites in Precambrian biostratigraphy remains controversial: contributions to Chapter 7 include a statement of the Russian view on their application to the Riphean, a thoughtful critique on intercontinental correlation, and a word of caution to be applied before assigning geological age solely on the basis of stromatolites. The ghost of the dogma that stromatolites are marine intertidal forms must surely rest with the assembled documentation in Chapter 8, recent models for interpreting stromatolitic environments: documented not only from the marine intertidal, but also in ephemeral carbonate lakes, in sabkhas, in nearshore algal mounds of a salt lake, from freshwater algal marsh, in bioherms in a freshwater lake, and from within hot-spring sediments.

Chapter 9 discusses features in the tectonic, atmospheric, hydrological and biological evolution of the earth which must

be considered when using the present to interpret the past; and concludes that the present is not the past, that application of recent data to ancient rocks must be done in the full understanding of the state of evolution at that particular time. Chapter 10 describes the use of stromatolites in palaeoenvironmental and basin analysis in a number of wide-ranging examples. This chapter is headed stromatolites in basin analysis, and it would seem that some part of it could more logically have been taken in the previous, palaeoenvironmental, chapter.

Chapter 11, dealing with the mineralization, lists mineral deposits associated with stromatolites, and also ranges broadly over biological processes and mineral deposition. The final chapter reveals available information on using stromatolitic lamination to provide evidence on the length of day, and thus the speed of the Earth's rotation, through geologic line. Without wishing to be pejorative it would appear that this approach has yet to yield much. Contributions to the conference on 'Biological clocks and changes in the Earth's rotation' at Newcastle-upon-Tyne in 1974 came for example largely from molluscs, corals, and geophysical and astronomical data.

There are four appendices: a glossary of terms, a table of time ranges of Precambrian stromatolites, a listing of available translations, and a subject index to the bibliography. The glossary is useful but could be better organized: a broader introduction; the handful of terms in the table at the end could easily have been incorporated into the glossary itself, while some of the features presented in a graphical summary of attributes are, like the 1969 origin, too small for the uninitiated to follow. The bibliography cites the references from the individual papers, and also several hundred additional stromatolite references.

The Editor took as his terms of reference that the field was a burgeoning, increasingly interdisciplinary one in which there was much unassimilated new information. He wished to balance reviews of established work with reports on new methods and research; and aimed to reflect the present state of knowledge accurately while producing a book useful to both the specialist and the new specialist.

Contribution to the book was by invitation. Three-quarters of the 42 contributors are from the USA or Australia, the balance from Russia, Canada, South Africa, France, and Belgium. Many of the papers are either on the Recent or from the Precambrian. (Additional interest in the field can be gauged from the program and contributions to the international symposium on Fossil Algae at Erlangen, Germany in October 1975—many of whom were Europeans working on Phanerozoic material.)

I believe that the book is timely and that its aims have been achieved. I congratulate M. R. Walter, the Editor, on his achievement.

The book is essentially error-free and well produced. I believe, however, that the

calibre of photographic material supplied as copy warrants the publisher choosing a finer screen than that used in the book. I would also enter a plea to the publisher that in a book of this sort a more individual dust-jacket be developed within the overall series.

The book is very strongly recommended to anyone directly involved or peripheral to the field. How well it will sell may, however, depend on how individuals, even institutions, face up to the cost.

J. F. T.

*Johnson, R. W. (Editor), 1976—**Volcanism in Australasia.** 406 + 16 pp. Elsevier, Amsterdam.*

Price: Dfl 60, approximately \$A22.20

Volcanism in Australasia is a handsome volume consisting of a collection of papers in honour of the late G. A. M. Taylor.

Tony Taylor, as he was always known, joined the Bureau of Mineral Resources in 1950 and worked as a volcanologist, mainly in Papua New Guinea, until his untimely death from a heart attack in 1972 while engaged in field work on Manam volcano. This volume, edited by R. W. Johnson, contains some 28 papers covering a broad spectrum of topics volcanological, together with a memorial to Tony Taylor written by Dr N. H. Fisher.

Naturally many of the papers have been written by colleagues of Tony Taylor, and, appropriately, nearly two-thirds of the contributions are concerned with aspects of the geology and geophysics of the volcanic areas and volcanoes in the Papua New Guinea region.

As noted by many of the authors this region is one of considerable complexity, although in broad terms it can be thought of as the zone of interaction between the Indo-Australian and the Pacific lithospheric plates. In detail several smaller plates are identified from the seismicity and the geometry. The complexity no doubt arises from the oblique convergence of the two major plates and the collision with, and choking of, a subduction zone by the continental mass of the southern part of Papua New Guinea at the leading edge of the Indo-Australian plate.

Johnson's paper on the volcanic arc at the southern margin of the Bismarck Sea highlights these points. He distinguishes a western arc, with no presently identifiable Benioff zone beneath it, and an eastern arc extending through New Britain which has a Benioff zone associated with it. This paper sets the scene for the six papers that follow in which descriptions are given of individual volcanoes of the South Bismarck Sea region, including accounts of many of the more recent eruptions together with appropriate maps and photographs, some in colour.

In addition petrographic descriptions and chemical analyses are provided in many cases, and show that tholeiitic basalt and low-silica andesite predominate. Similar information also is given for Bagana, one of the andesitic volcanoes on Bougainville.

The two papers by Whitford and Nicholls on Quaternary volcanism in the western Sunda arc in Java and Bali provide a wealth of new information on a region that appears to be geotectonically much simpler than northern Papua New Guinea. Whitford and Nicholls confirm and greatly extend previous work that had indicated that the K_2O content of rocks with the same SiO_2 content increases regularly with increasing depth to the well-developed Benioff zone under Java; they conclude that the magmas were derived from the mantle wedge above the Benioff zone.

In the second paper Nicholls and Whitford demonstrate that basaltic andesite and andesite are the dominant rock types in the western Sunda arc volcanoes and that the range of composition of the lavas can be accounted for mainly by crystal fractionation of more mafic primary olivine tholeiite magmas derived from partial melting of mantle peridotite.

A most useful summary is given by C. D. Branch of the life cycle of andesitic stratovolcanoes and the common association of porphyry copper deposits with intermediate to acid subvolcanic stocks within these volcanic edifices. In addition Branch notes that favourable environments for deposition of lead, zinc and gold, mercury and sulphur deposits may occur associated with these stratovolcanoes.

Because of the tectonic complexity of the Papua New Guinea region perhaps it is not surprising that there is considerable volcanic activity that is not readily fitted into models of magma generation related to subduction zones at convergent plate margins.

D. E. Mackenzie presents much petrographic and geochemical information on 16 late Cainozoic volcanic centres, mainly stratovolcanoes, that are found scattered through western Papua New Guinea where the crust is decidedly continental in character. Basaltic rocks ranging from high-K shoshonitic types to low-K types are dominant in 11 of these centres, whereas andesites, with high to moderate K contents are most abundant in the other volcanoes. The absence of any presently identifiable Benioff zone under this region leads Mackenzie to suggest that the magmas were derived from the low velocity zone in the upper mantle as a consequence of uplift subsequent to plate collision and crustal warping.

Pain and Blong map and describe a number of late Quaternary tephras in the vicinity of Mount Hagen and Mount Giluwe, two of the volcanoes considered by Mackenzie. Likewise Quaternary peralkaline rhyolites of the D'Entrecasteaux Islands situated off eastern Papua cannot be readily understood in terms of a convergent plate margin setting and are more typical of regions of crustal extension and rifting; in his paper describing these rocks I. E. M. Smith suggests that the tectonics of this region are indeed of the latter kind.

Johnson, Wallace and Ellis describe and geochemically characterize an unusually wide range of volcanic rocks from islands situated to the northeast of New Ireland. Rocks range from basanites, tephrites, olivine nephelinites through to alkali