

BOOK REVIEWS

Cook's tour

Anderson, J. G. C. *Field Geology in the British Isles*. Pergamon, Oxford, 324 pp. Price: hardcover US\$35.00, £19.50; flexicover US\$16.00, £8.95.

This book's sub-title 'A Guide to Regional Excursions' more accurately describes its contents. After four pages of introduction and four pages of general information, there are 278 pages describing 194 geological itineraries in the British Isles. The itineraries are divided between six chapters, each based on a terrane, namely: Precambrian, Caledonian with metamorphism, Caledonian without metamorphism, Hercynian, Alpine and Tertiary Volcanoes. Each terrane is subdivided into convenient geographical/geological units, for example, the Welsh Block, the Lake District, the Southern Uplands, the Southern Uplands in Ireland, SE Ireland in the Caledonian non-metamorphic chapter. Each of these units has its own geological sketch map of variable quality, a brief introduction to the geology and is further broken down into Centres upon which a number of excursions are based. Detailed geological maps are provided for only some 25 of the 83 excursion centres; most of the excursion routes are shown on maps which are blank other than for occasional railways and selected names and topographical features.

Each excursion is discussed under the headings, "Access", "Maps", "Walking distances" and then follows a description of a day's itinerary in an average of 300 words. The final chapter (24 pages) describes the geology of some rail, road and ferry routes.

The aim of the book is to describe "as many facets as possible of British Geology" and clearly the author felt he should also give as wide a geographical coverage as possible. Thus itineraries range from Shetland to the Isle of Wight, from Connemara to East Anglia, though the Isle of Man and the Channel Islands are not represented. This, I feel, is the author's first mistake; it is impossible to usefully describe 194 itineraries in the given space. The itineraries, for the most part, are a hectic Cook's tour: thus at Start Point (p. 169) we are taken to just two groups of exposures described in six lines; on Anglesey (p. 111) we are told to "examine exposures of Carboniferous Limestone" and continue to Traeth Lligwy where "there are exposures of red sandstone". These exposures contain some fascinating palaeo-ecological and sedimentological features apart from their structural interest. Further on we are told to look out for the Wylfa Nuclear Power Station but not to look at the mélange on which it stands, surely one of the most dramatic rocks in Britain. In Connemara (p. 102) the one excursion in the Dalradian takes us to just two marble quarries and the boulder bed. On the Berwickshire coast (p. 138) our attention is not directed at all to the dramatic folds in the Silurian below, as we walk along the cliff top. Partly as a consequence of this lack of detail, the descriptions rarely develop any geological theme. In 100 well-chosen itineraries, the author could have usefully described some actual exposures which would have brought out the essential sedimentological, igneous, and structural features of a particular terrane. For instance, instead of briefly mentioning Dalradian rocks in some 15 different itineraries, three excursions from northwest to southeast across the SE Gramscians, with the sediments, volcanics and structures put into the context of one cross-section would have real teaching value. As it is, we have confusing references to folds with F and D numbers, to the Illtay (?) Nappe and other major folds which are placed in no context at all. Even an excursion across the demonstrably downward-facing folds at Loch Lomond makes no reference to their structural significance.

Unfortunately, the author claims that "all important outcrops, contacts, structures and igneous intrusions are localised". Throughout the book I could not find one single reference to the National or Irish Grids, either in the text or on the maps. In very rare instances are road numbers used. Thus in Anglesey (p. 111) we are told to "drive or walk (from Holyhead) W. by S. to South Stack"; in Connemara (p. 102) we are told to walk N. (from a quarry) to the W. slopes of Lissoughter to find the boulder bed. For these and hundreds of other localities six (or preferably eight) figure grid references are essential; they would remove a lot of descriptive text and direct the reader to the precise locality.

The book is often out of date or mistaken in its information and references. The Newborough pillow lavas (p. 111) are described not only as part of the New Harbour Series but also as Precambrian; there is no mention of the context of Anglesey in North Wales geology, let alone the recent re-interpretation of the Mona Complex. Pebbles at Collieston (p. 74) are elongated in C and fold axial-surfaces are consistently referred to as axes. Thus at Dobb's Linn (p. 141) the anticline has "a N. 5°E axis which oscillates about the vertical so that strata are inverted in opposite directions in different places". Arkosic, low-grade metamorphic rocks are described as "granulites". The Silurian of the Berwickshire coast is ascribed to the Southern Belt of the Southern Uplands.

The reference lists could have been used to supplement the detail lacking in the text. But the many published papers and excellent excursion guides which do give precise details of localities are not mentioned. The only references to the Southern Uplands are to a 1932 paper on the Loch Doon granite and a totally incorrect one to the Regional Geology series of H.M.S.O.

I have looked at this book primarily from the point of view of the structural geologist. Moreover, I only felt justified in criticising excursions to areas that I know well myself. It is possible that the other sections (to the less deformed Hercynian and Alpine terranes) are more dynamic, accurate and better referenced. There is certainly a need for detailed excursion guides to many areas of the British Isles; even more useful would be a source-book to all the widely scattered guides and papers that do exist. This book, I regret, fills neither of these needs.

Jack Treagus

Global processes

Miyarshiro, A., Aki, K. & Şengör, A. M. C. 1982. *Orogeny*. John Wiley, New York, 242 pp. Price: softcover £8.40.

This book was originally published in Japanese in 1979 but now has been revised and translated into English. There are only five chapters in the book and each has been written solely by one of the authors. They do admit in the introduction that there were considerable differences of opinion on the problems covered by the book and that they have left some important problems untouched. They suggest that the subject matter is too wide and diversified for a small group of authors to cover comprehensively and this admission, of course, makes my job as reviewer doubly difficult. In the first chapter Şengör, a tectonic geologist, reviews the classic theories of orogenesis from pre-Christian times up to 1945. I have to admit that I found this chapter the most illuminating in the whole book. British geologists, by nature, are notoriously bad at foreign languages. Most of the early tectonic literature, with the exception of a few American workers, seems to have been mainly written by German-speaking authors and hence their views are probably not well known by most British geologists. Şengör succinctly covers the development of orogenic theories, the early arguments between mobilists and fixists and the brave attempts of authors like Argand to incorporate the movement of continents into orogenesis. Some surprising facts appear in the first chapter: Steno in 1669 was already trying to restore deformed rocks to their undeformed state; Sir John Herschel, an astronomer, incorporated isostasy into a model of a sedimentary basin 33 years before it formally re-appeared in the literature. At the end of this chapter the British reader is left wondering why Scotland and England, the home of Hutton and Smith, did not play a more important role in the development of tectonic ideas. Probably the Alps were such an important spur to the German speakers who were then drawn along the strike of that mountain belt towards Asia which influenced Suess so much. One is also left with a reminder of the elegance of Argand's Alpine sections which look so modern with a sole thrust beneath the external massifs and an imbricate thrust stack drawn within the massifs.

The second chapter was written by Miyashiro and covers the advent and development of plate tectonic theory. The subject is adequately covered but I often felt that a few more diagrams would have helped the discussion. To be fair to Miyashiro it is probably beyond the task of any writer to cover completely plate tectonics in 70 pages. One serious omission, which probably reflects the age of the original Japanese edition, is the lack of discussion in any detail of the appearance of exotic terranes in orogenic belts. We now know that mountain belts can be built up piecemeal by the docking onto the edge of a continental plate of continental fragments and bits of island arcs after they have been carried for many hundreds of kilometres by sea-floor spreading. Oblique plate collision can transport terranes along major strike-slip faults away from their initial point of docking. Even the huge granite batholiths of British Columbia were not immune to this transport; they were originally intruded down in California! This concept poses the tectonic geologist, who wishes to restore and unravel an orogenic belt, with a difficult or perhaps insoluble problem. Certainly this is a subject for a second edition.

I enjoyed the third chapter, again by Miyashiro, on the petrology of orogenic belts. However, his discussion of the metamorphic petrology adds nothing to previous accounts written by him. I was educated by his review of the igneous petrology of orogens. Basically he concludes that petrologists are still not certain of the source of magmas: theories range from genesis in the descending plate of a Wadati–Benioff zone, in the asthenosphere above the descending plate, in the crust above, or by complicated reactions between fluids, magmas and solids in all these zones. Petrologists cannot yet explain the geochemical enrichment of K_2O in the magmas away from the subducting side of the Wadati–Benioff zone. The structural geologist who spends a few hundred pounds a year in field expenses is left wondering if the geological

sciences are getting value from the igneous geochemist, petrologist or experimentalist.

Chapter 4 is a review by Aki of the geophysics of orogenic belts. Here I found my reading speed cruising up into overdrive, a practice I use to skim through data. Equations and graphs flashed past my eyes but basically the chapter is about limit analysis and attempts to estimate the physical forces and stresses involved in orogenesis and plate movement. Like most other analyses of this sort both low stresses of a few hundred bars and high stresses of a few kilobars pop out of the equations. Most earth scientists have to conclude that we are still in the dark ages in estimates of this sort.

The final chapter, by Miyashiro, is a review of orogenesis in the Precambrian and he concludes that things were different then and not like the present-day plate regime. However, most of this chapter read like a good summary of the excellent texts by Brian Windley, so the typical reader will learn little here. Then the book ends: no summary, no review, no conclusions and this is usually one of my damning criticisms when I mark student essays.

Hence all in all a rather patchy book. There are obvious omissions. No discussion of sediments and sedimentation which can randomly precede orogenesis but which settle down to predictable patterns once deformation and plate convergence begin and after convergence ends. But because of the unconnected, patchy nature of the chapters the book can be picked up and isolated chapters read at random in any order and most readers, students and lecturers, can learn quite a lot from this book. But as I finish I sit here and dream of a book written by John Dewey, Dan McKenzie, Ron Oxburgh and Harold Reading on the same subject. Now that would be a book and a half! Some British publisher ought to get them signed up now.

Jake Hossack