

crust. There is an almost complete sequence of rocks, from mélanges, deep water cherts and shallow water limestones to the igneous rocks ranging from serpentinitised peridotites, through layered and massive gabbros, and sheeted dykes, to pillow lavas and inter-pillow hyaloclastites. Low grade thermal metamorphism due to hot circulating solutions has resulted in zeolite and greenschist facies rocks and these same fluids have leached out copper from the lavas and dykes and deposited massive Cu sulphides in the pillow lavas. The tectonically repeated complex, which formed at a spreading centre in the Tethyan Sea, is allochthonous, having been driven southwards.

The final paper in the volume 'Chromites from the Al'Ays complex, Saudi Arabia, and the Semail Complex, Oman' by Neary & Brown describes the field occurrence and chemistry of chromites from two almost complete ophiolite sequences. Different trends are recognised, and the origin of the lenses are ascribed to crystallization in mini magma chambers (0.5–1 km) within the main intrusion.

This reviewer would again voice the hope that a good index be provided for the completed four volumes and, as a bonus, would like an authoritative summary of the consensus on the present thinking on the evolution of this part of the crust.

R. Bradshaw

Perimediterranean Tectonics

Lemoine, M. (editor) 1978. *Geological Atlas of Alpine Europe and Adjoining Alpine Areas*. Elsevier, Amsterdam. 584 pp. Price: hardcover US \$170.75.

This large, heavy and handsome book costs US \$170.75 (about £76 at January 1980 rates) and thus seems destined solely for the outside shelves of some libraries: few individual geologists could afford it. It appears to be a new type of geology book, being a collection of previously published maps, sections and stratigraphic columns arranged in fourteen chapters each introduced by a brief explanatory text. Excluding the three introductory chapters the average ratio of pages of text to illustrations is 0.15.

Marcel Lemoine, the editor who is also author or coauthor of five chapters, appointed fifteen other geologists, mainly from France, to compile the remaining chapters. When judging the book it is important to understand the editor's thinking. Lemoine states in his preface: "It has been our objective, above all, in this book to achieve two main objectives: (1) to fulfil a need, namely that of providing *information by means of images*, and (2) to remedy the problem of the *wide dispersion of this information*"; and "... we have limited ourselves to what appeared to be the essentials, the basis of every geological image of a continent, namely its structure and its structural evolution". Thus Lemoine justifies the selection of illustrations which present 'facts' rather than theories. All figure captions are in English and set out in a uniform style. A few figures were specially drawn or redrawn for the book; they are of noticeably better quality than some which have been reproduced with little or no change from the originals.

The geographical scope within Europe is from the west of the Iberian Peninsula to the Caucasus, but the book also embraces the Maghrebides of North Africa and the Alpine chains of Asiatic Turkey. The nappes of the Maghrebides, but not the Atlas ranges of the African block, are included because they link the Betides of Spain with the Calabrian–Sicilian arc. The Pontides and Taurides of Anatolia are included because it is argued that they are the direct continuations of the Alpine–Carpathian and Dinaride–Hellenide belts respectively. Wisely, the editor has also included accounts of Cenozoic structures within the Iberian Meseta, the Corso–Sardinian block, and the Moesian platform. These units which remained relatively stable during the Alpine orogeny are wholly or partially enclosed by Alpine chains, and their Cenozoic tectonic evolution is intimately associated with those chains.

The book commences with fifteen preliminary pages containing among several items two coloured maps at 1:22,000,000 showing the relief and structure of Europe, and a preface in which Lemoine explains the thinking behind the project.

The first chapter by Ellenberger & Lemoine is a perceptive account of the history of European tectonic thought and the influence upon it of political and philosophical ideas. Lemoine is the sole author of Chapter 2, a concise and well-constructed synthesis of the principal components of the Perimediterranean Alpine chains and their relationships to external and internal stable blocks. We are reminded about the original notions of intracrustal subduction as envisaged by Alpine geologists such as Ampferer in 1916, and Amstutz and Kraus in the 1950s. Despite its merits the chapter has a somewhat old-

fashioned flavour; there are no references later than 1975, even *Mesozoic–Cenozoic Orogenic Belts* (Geological Society of London: Special Publication No.4) which appeared in 1974 is not cited in this chapter, or in any of the succeeding regional chapters. The content of the explanatory text accompanying Chapter 3 on the Mediterranean Sea is disappointing, and the bibliographic details of some papers which are cited in both this chapter and Chapter 2 are given differently in the two reference lists, a careless slip considering the editor is the author of both chapters.

Rather than catalogue the relative merits of all eleven regional chapters I have selected for comment only a few, and hope that they are representative. Manuel Julivert ably summarises and illustrates in Chapter 4 aspects of Cenozoic tectonics in the 'stable' block of the Iberian Meseta — a province whose 'Alpine' structures are generally neglected because they lie between the orogenic belts of the Pyrenees and Betides. By reproducing Riba, Puigdefabregas and Quirantes' previously unpublished maps and sections of the Ebro Basin the author of this chapter has probably introduced some geologists to one of the best preserved and exposed post-tectonic molasse basins. However, it should be noted that in the legend for the lower map of Fig. 4.8 the ornaments for the Oligocene and the Lower and Middle Miocene appear to have been transposed, if the convincing distribution of these rocks in the upper section of Fig. 4.10 is correct. An account by Durand-Delga & Lemoine of Alpine structures in the Pyrenees and Lower Provence follows in Chapter 5 and gives greater emphasis than is customary in articles on Pyrenean structures to the tectonics of lower Provence. This is a welcome departure probably reflecting the French outlook of the authors.

Although Chapter 8 is the second longest (68 pages) Lemoine was obliged to be especially selective considering the quantity of available material on the Jura and Alps. It must have been a challenge to write yet another brief synopsis of the tectonics of a region which has been so thoroughly investigated and summarised. Literature published after 1973 is not referred to or used as a source of illustrations.

The explanatory text and selection of illustrations compiled by Bergougnan, Brunn, Fourquin, de Graciansky, Gutnic, Marcoux, Monod, & Poisson for their account of the Alpine chains of Anatolia and Cyprus is a feeble outcome for an enterprise undertaken by so many experts. Apart from reproducing Pavoni's (1961) highly speculative map of units displaced by the North Anatolian fault they do not discuss or illustrate the mosaic of semirigid microplates which make up this western extension of Asia. An even more striking omission is a map of Anatolian–Aegean seismicity. Figures 2.12–2.14 in Chapter 2, which show the seismicity of the entire Mediterranean region, only partly offset this deficiency; their small scale does not allow the reader to appreciate the detailed pattern of seismic zones now recognized in the northeastern Mediterranean area.

In summary: the strength of the *Geological Atlas of Alpine Europe* is that for the teacher of tectonics or researcher about to start work in the region it provides a catholic set of references and illustrations within a single, if somewhat unwieldy, book. Its principal weakness, apart from that arising from the uneven quality of different chapters, is that even when originally published it was significantly out-of-date. For an investment of \$170.75 most potential purchasers would wish for a product likely to remain a definitive work for a reasonably long period of time.

P. L. Hancock

Metamorphic Rocks of Asia

Sobolev, V. S. (General Coordinator) 1978. *Metamorphic Map of Asia* (at 1:5,000,000). Moscow. Distributed by Pergamon Press, Oxford. Price for 9 sheets: \$118.00.

The map, on a scale of 1:5,000,000, and printed on nine sheets including one sheet of titles and one of legend, was compiled at the Institute of Geology and Geophysics of the Siberian Branch of the USSR Academy of Sciences on the instructions of the Subcommittee for Cartography of Metamorphic Belts of the World under the Presidency of Professor H.J. Zwart.

As with the previously published map of Europe the various metamorphic facies and their subdivisions are printed in colour and the age of the metamorphism is indicated by symbols. A comparison of the legends of the two maps shows that the one under review is much less detailed, perhaps not surprising in view of the huge area covered, and that there is no uniformity of ornament.

Much of the exposed rock in Asia is of sedimentary or igneous origin, commonly of great thickness, yet this map shows not only the types of metamorphism actually seen but also the types to be expected,

from geological and geophysical evidence, under the sedimentary cover. For example, almost the whole of Saudi Arabia east of the Shield is said to be underlain by 'undifferentiated amphibolite + greenschist facies'. It is only 'deep depressions filled with unmetamorphosed sedimentary rocks', such as the Ganges Plain and the Tigris-Euphrates valley, which are left blank.

The legends and explanations are mostly in English with one or two minor paragraphs in Russian. The names on the map are in part Anglicised but in many cases are transliterated so that we have, for example, Aralskoje More (Aral Sea), Laut Jawa (Java Sea) and yet South China Sea.

There are several misspellings (e.g. Bar of Bengal, Persjan Gulf) and perhaps one or two mistranslations such as middle pressure facies instead of intermediate pressure, as used on the European map. Some of these minor errors could have been eliminated by closer editorial collaboration. The maps are well produced and printed on stout paper.

In spite of the criticisms, however, the map is to be welcomed in that it summarizes, albeit in a most generalized way, a lot of information not generally available.

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