(A. B. Smith and Xu Juntao); Sedimentology, palaeoecology and palaeoenvironments (M. R. Leeder, A. B. Smith and Yin Jixiang); Plutonic rocks (N. W. B. Harris, Xu Ronghua, C. L. Lewis and Jin Chengwei); Volcanic rocks (J. A. Pearce and Mei Houjun); Metamorphic rocks (N. W. B. Harris, T. J. B. Holland and A. G. Tindle); Ophiolites (J. A. Pearce and Deng Wanming); Palaeomagnetism (Lin Jinlu and D. R. Watts); Isotope geochemistry (N. W. B. Harris, Xu Ronghua, C. L. Lewis, C. J. Hawksworth and Zhang Yuquan); Geological mapping (W. S. F. Kidd, Pan Yusheng, Chang Chengfa, M. P. Coward, J. F. Dewey, A. Gansser, P. Molnar, R. M. Shackleton and Sun Yiyin); Structural geology (M. P. Coward, W. S. F. Kidd, Pan Yun, R. M. Shackleton and Zhang Hu); Quaternary and active faulting (W. S. F. Kidd and P. Molnar); Cenozoic uplift and deformation (R. M. Shackleton & Chang Chengfa).

The general reader will welcome the extremely valuable final chapter of synthesis of the tectonic evolution of Tibet (J. F. Dewey, R. M. Shackleton, Chang Chengfa and Sun Yiyin). The broad picture that emerges from the wealth of new information is that the Tibetan Plateau is an assemblage of terranes or microplates which were accreted to Asia before the Indian–Asian collision in the mid-Eocene. The history starts in the later Precambrian as there is no evidence of Archaean or early Proterozoic rocks and it seems that crust of 1000 Ma or older occurs beneath the Plateau. There is evidence of an end Proterozoic ('Pan African') collision.

The later Palaeozoic and Mesozoic history of terrane assembly and dis-assembly with the formation of the Kunlun–Qinling suture (late Permian), the Jinsha suture (late Triassic) and the Banggong suture (late Jurassic) involved a succession of Palaeotethyan oceans and a Neotethys which opened in the Trias between the Lhasa and Himalayan Terranes, reached a width of at least 6000 km, and then closed in mid-Eocene times. The terrane nomenclature is a little confusing but the broad picture is clear enough. Significantly at least two of the terranes (Qiangtang and Lhasa) come from Gondwanaland and split away from it as late as the Permo-Trias.

Discussing the Tertiary history, the authors of the synthesis favour the England–McKenzie–Houseman viscous continuum deformation model, rather than the earlier indentation model of Molnar and Tapponnier. Thus the thickening of the Tibetan crust to almost double the normal thickness resulted from northward-migrating N–S shortening and vertical stretching occurring between the mid-Eocene and the earliest Miocene. Uplift in Tibet therefore is held to precede that in the Himalaya, hence the formation of the famous antecedent drainage. In this period (Phase 1) India moved north relative to Asia by 1000 km. Palaeogene and older strata on the Plateau were deformed by this essentially thrust-dominated process. Pediplanation had produced an erosion surface by mid to late Miocene times (~10 Ma). In Phase 2, northward-migration thickening became 'locked', because the strong lithosphere of the Tarim Basin resisted the deformation. Instead the northward motion of India was accommodated partly by thrusting in the Himalaya. In Phase 3, from the early Pliocene to the present day, the Tibetan Plateau has risen by about 2 km and has suffered E–W extension across N–S grabens and along conjugate strike-slip faults. Rapid uplift was accompanied by volcanism. The synthesis invokes catastrophic delamination of the thickened lithospheric 'root' beneath the Plateau. The indentation model of Molnar and Tapponnier is not favoured because there is little evidence of eastward lateral extrusion. During Phases 2 and 3 some 1420 km of India–Eurasia convergence has been partitioned into about 440 km of shortening on the Himalaya and about 980 km north of Tibet. The late-stage extension seen on the Tibetan Plateau may perhaps give a key to understanding the process whereby orogenic belts return to normal crustal thickness.

The authors of the synthesis are careful not to claim that they are presenting other than their own views. But the 'general' reader would have found it helpful to have important disagreements set out in an introductory chapter. The conclusion by Coward *et al.* that thrusting is not intense enough to account for the crustal thickening is one notable example of disagreement. Again the role of lateral extrusion is still controversial. Dewey *et al.* reject lateral extrusion as a primary response to indentation, one reason being that it fails to account for the crustal thickening just ahead of the indenter.

Collision tectonics, terrane assembly, crustal thickening, mechanisms of uplift, delamination of the lithosphere, extensional tectonics, lateral extrusion—these major topics of interest to Earth Scientists are central to the understanding of the evolution of Tibet and the Himalaya. In this sense this book is a very important document. Let us hope that it does not mark the end of an era and that the many pathways for research opened-up here will be pursued in the near future.

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Structures at Bedtime?

Roberts, John L. 1989. *The Macmillan Field Guide to Geological Structures.* Macmillan Press Ltd, London. 250 pp. Price £12.95.

This pocket-sized and (just) pocket-weight book is billed by Macmillan to be a valuable reference book for amateur geologists on fieldtrips. That may be so, but it will doubtless grace their coffee tables, along with those of their professional colleagues.

Almost every geological structure of sedimentary or tectonic origin, together with a good many igneous and metamorphic features, is photographically illustrated in this guide. The 254 photos which form the kernel of the book are grouped in threes on the right-hand side of each double page, with supporting text on the facing left page. Text and photographs together are organized into six parts; sedimentary rocks; igneous and metamorphic rocks; unconformities and the geological record; mountain building and the tectonic record; structural relationships in folded rocks; and basement rocks.

This book forms a spectacular collection of superb colour photographs. These have obviously been taken by John Roberts over many years of geological travels and we would guess after more than one visit to some localities. Our favourites include a French bioturbated limestone from Avecail and cleaved graded beds from Islay in Scotland. The famous breached fold pair at Broad Haven, SW Wales, must surely have been specially floodlit and an artificial blue sky dubbed in later! The photographs are undoubtedly the high spot of this book, and paradoxically it would be a shame to ruin them by taking them into the field to be rained on. For the enthusiast, details of film and photographic technique have been included in a paragraph at the front of the book, together with a note that slides and copies of photographs are available from the author: he deserves to do a roaring trade.

In stark contrast to the photographs, the text is disorganized and must seem almost haphazard to the non-specialist. Two examples illustrate the point. "Metamorphic processes" are in section 2 together with igneous rocks, whereas "metamorphic fabrics" are in section 4 with mountain building, and "migmatites and basement gneisses" are in section 6. Section 2 is billed as igneous and metamorphic rocks, and the introductory text does describe the nature of igneous and metamorphic rocks at a fairly basic level, but the photographs in this section are almost all of igneous features, with just a few dealing with igneous contact rocks. No regional metamorphism here at all.

For the most part, though, the text is clearly written and will be readily understood by a reasonably informed and interested amateur geologist. Sadly, some parts, for example the section on crenulation cleavage, require a pretty full understanding of the concept before you can grasp the meaning of the text. Some of the definitions compound the problem; the term "lag" is incorrectly defined, and mysterious terms (to us) such as "fishtail" and "snake's head folds" appear in the text.

Not withstanding these criticisms, the book will be of considerable use for the non-specialist. If you are looking to see an excellent example of a dyke or a load-cast or a normal fault, this guide is well organized enough to let you do it. Enthusiasts who want to go and see these structures in the field could, however, be hard pushed to find them. An accurate location along the lines of "300 metres south of Wigan Pier" would have cured this. The grid reference quoted for each locality is precise enough, but field parties may well have difficulty locating the exact site of the photograph, within the 100 m^2 of the grid reference. Amateurs and aspiring professionals will, perhaps, miss some discussion about the setting of the feature within its wider stratigraphic or tectonic context. Almost all the examples come from

the British Isles, and most from Scotland or northern England, but those of you who live abroad (including south of Watford) don't despair, they say travel broadens the mind.

The indexing is very good, enabling the reader to find a particular type of structure and where to go to look for it, or to see at a glance which interesting structures are close to your holiday cottage. The index annoyingly refers to the plate number rather than the page, but the clever use of text and diagrams stops these getting out of step until the last few pages.

When you first open up this guide you will become carried away by the photographs, which are indeed superb. Unfortunately, they don't always help the student *understand* structures. The book illustrates all types of structure, be they igneous, sedimentary or tectonic. Full-time geologists usually know the difference, but we feel it may be a bit too difficult for the "amateur naturalist", at whom the book is targeted, to recognize and identify structures when looking at their own, local rocks. But the photographs alone warrant having the book—we just feel it would have been better and more effective with twice the number of photos and half the text, probably in the form of an atlas. It certainly represents good value at £12.95.

We are not going to spoil our copy by taking it into the field. Instead, we shall keep ours on the bedside cabinet, to fill in any dull, late evening moments dreaming of structures we might, one day, see.

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