



BOOK AND MAP REVIEWS

Sediments in deformation

The Geological Deformation of Sediments. Chapman & Hall (1994). 362 pp. ISBN: 0-412-40590-3. Price £69.00 (Hardback only)

This book deals with many of the theoretical principles of sediment deformation and their application to geological problems. The book is a collection of papers by internationally recognised researchers covering much of the aspects of sediment deformation.

The introductory chapter by A. Maltman is an overview of terminology, a review of mechanical aspects of sediment deformation and the causes of such deformation. The last section deals with melanges. Chapter 2 by M. E. Jones takes a more in depth look at the mechanical principles of sediment deformation. Both Chapters 1 and 2 provide well-written and accessible information on the physical nature of sediment deformation, the ways in which deformation is experimentally measured, and something on rheological models for deforming media. Glacial deformation is considered in Chapter 3 by T. Murray. In many respects, I found this chapter rather weak, particularly given the amount of information available on glacial deformation and deformational features. This chapter would have benefited from more illustrations, a more quantitative approach to deformation resulting from ice-movement, a discussion of ice shelves and, for example, the formation of subaqueous gauge features produced by grounded sea ice and icebergs.

Chapter 4 concerns sedimentary deformational structures (J. Collinson), and Chapter 5, mass movements (O. Martinson). Together, these chapters cover most aspects of wet-sediment deformation structures linked to sedimentary processes and sedimentary environments. A notable absence, however, is any significant discussion of volcanic deformational structures, for example those associated with pyroclastic flows. A further disappointing aspect of both Chapters 4 and 5 is the lack of illustrated descriptions and explanations of some of the really impressive continental-margin sediment slides and debris flows documented in the marine geological literature; for example off the continental margin of West Africa and from the slopes of the Hawaiian volcanic edifices. Admittedly, there is an over-reduced diagrammatic interpretation of a transect across the Niger Delta, showing growth faults, a planform sketch of sediment-slide scars from the Mississippi Delta, and a seismic line across a differentially-compacted submarine channel from the northern North Sea. A few more seismic sections with line interpretations would have served to emphasise both the diversity and the large scale of many of these deformational features. Additionally, there are excellent sidescan sonar examples of mud diapirs and mud volcanoes from accretionary prisms and trenches, and sidescan sonar pictures of sediment slides on the seafloor, but the book contains no sidescan sonar images.

The next three chapters (and large parts of the last chapter) appear designed for aficionados of thrust-and-fold belts, particularly accretionary prisms. Chapter 6 concerns tectonic deformation stress paths and strain histories (D. Karig and J. Morgan); Chapter 7, fluids in deforming sediments (K. Brown); Chapter 8, sediment deformation, dewatering and diagenesis, with examples from selected melanges (T. Byrne), and Chapter 9, deformation structures preserved in rocks (A. Maltman). I particularly enjoyed reading Chapter 6, probably because I found this to be the most philosophical approach and, whilst adopting a quantitative approach where possible, emphasised the uncertainties in our current understanding of sediment deformation. Here, I would like to quote a couple of sentences which resonated with me to all those who seek research grants or adjudicate on research grant-awarding committees: "*The principal conclusion to be drawn from this review of tectonic deformation of sediments is that, despite the recognition of and interest in the mechanical behaviour of sediments, much more quantitative information is needed from in situ observations and from experimental deformation. Moreover, this information must come from focused and problem-oriented investigations.*"

Overall, the chapters are well chosen to contribute to a nicely balanced set of papers with minimal overlap of content. The line drawings are generally clear and useful. However, given the importance of a well-illustrated text, it is a pity that many of the photographic plates are of poor quality.

This is a book that will appeal to researchers and teachers who require an overview of the nature and origin of deformed sediments. The target readership of postgraduates and professionals in the fields of structural geology, sedimentology, glaciology, engineering geology and geomorphology, will find this book useful. There is a comprehensive bibliography at the back of the book. It is a well-presented and well-illustrated. The price is definitely on the high side (£69.00), something that will almost certainly guarantee that only the most wealthy of students might acquire a personal copy. Despite the price tag, this is a book that Earth Science libraries should have available on their shelves.

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Compilation map: Pakistan Himalaya

Searle, M. P. and Asif Khan, M. (editors) 1996. *Geological map of North Pakistan, and adjacent areas of northern Ladakh and western Tibet*, M. P. Searle, Oxford University, Oxford. Price (nominally) £40 or US\$60. Rolled or folded.

The general lack of precedent for the review of a map in this and other journals perhaps reflects the indifference of map publishers in a traditionally limited market and their failure to supply material for review. The bandwagon of entrepreneurship that is creeping into the sciences seems not to have rolled over Searle and Asif Khan who have edited and produced a "self-published" compilation map of northern Pakistan. The map is a bit larger than a square metre and is printed in high colour. At 1: 650 000, it extends from the Salt Range thrust (the lowermost thrust of this part of the Himalaya) approximately 500km to the Kunjerab pass (south of the Karakoram Fault; a nominal boundary of the Tibet plateau) thereby encompassing the Pakistan Himalaya *sensu lato*. The map is a compilation with twelve named as principal authors: M. P. Searle, (Oxford, U.K.); M. Asif Khan and M. Qasim Jan, (Peshawar, Pakistan); J. A. DiPietro, (Southern Indiana, U.S.A.); K. R. Pogue, (Whitman College, U.S.A.); D. A. Pivnik and W. J. Sercombe, (Amoco Inc, U.S.A.), C. N. Izatt, (British Gas, Pakistan); P. M. Blisnik (Dartmouth College, U.S.A.); P. J. Treloar, (Kingston, U.K.); M. Gaetani and A. Zanchi, (Milano, Italia). These, along with their students and co-workers, represent a significant portion of the research in the Pakistan Himalaya. The author list (and the main sources list) probably reflects feedback to a call for contributors by the editors about sixteen months ago via a now-expired Himalayan researchers internet newsgroup. It is perhaps telling that many of those included have published their maps elsewhere, and the more conspicuous absences (such as recent unpublished Italian and French mapping) reflect an unwillingness on the part of the 'unpublished' to see their work amalgamated in such a manner. The notable exceptions here are the inclusions of the detailed mapping represented by six unpublished English Ph.D. theses (Pudsey, Sullivan, Peterson, Williams, Izatt and Chambers) along with mapping and other data from industry and the Pakistan Geological Survey. It is in making such datasets available that map compilations such as these have their advantage. A longer time period, however, between the call for contributions and publication (early 1996) might have enabled a fuller agreement amongst the Himalayan community working in this area and hence encouraged more 'unpublished' to come on board.

The compilation involves selective dissection of about 30 or so named maps and snippets from others. The compilation assembly is depicted with a frightening mosaic at the side of the map proper. The mosaic within the compiled map is also apparent to those familiar with geologic cartography; the different map-making styles are quite lucid and contrast sharply with one another. Although the mosaic should serve to apportion responsibility, there is blurring where more than one map is accredited to one area. In some areas there would appear to be a confusion of whose work is compiled; for example, Fontan and Schoupe (1995) seem to be credited for much of the Greco and Spencer (1993) compilation (whose compiling sources, incidentally, are not named). In the case of the editors' own mapwork, it is interesting to see where modifications have been chosen. For example, from the map that accompanied Searle's (1991) Karakoram text, imbricate thrust slices have been retained in preference to tight, south-verging folds to explain the repeated marble bands in the southern Karakoram Terrane in Hunza valley. Additionally, the Stack fault at the eastern margin of the Nanga Parbat–Haramosh massif is still shown as trending ~N–S although it is now well-recognised to trend more NW–SE. Changes include a boldly drawn, ~N–S normal fault on the western margin of the massif, structurally below the MCT.

On the map, the lithological divisions are broadly grouped within traditional Himalayan 'terranes' (Hindu Kush, Karakoram, Kohistan, Nanga Parbat–Haramosh, Himalayan, Sub-Himalayan and 'Granitics') of which, strangely, only the Himalayan Terrane section (not the largest) enjoys a paragraph of general introduction. There is an attempt to put the Himalaya and Sub-Himalaya sections into stratigraphic order, with unconformities drawn for the latter. The lists of lithologies that make up the groups are very dense and unrevealing of the nature and contrasts of the field geology. There could be more acknowledgment of who has described what, and what has been assumed in matching lithologies amongst the source maps. For example, the editors have (sensibly, in my view) opted for the Greco *et al.* (1989) Mesozoic re-interpretation of Wadia's (1931) Precambrian Salkhala formation, but surely the debate is not over so quickly.

For readers of this journal, the main interest probably lies in the cross-sections. There are three cross-sections which together approximate a section through the Pakistan Himalaya. The editors have again made the most of the English Ph.D. theses here, in choosing where to run the cross-section lines. Other cross-section locations might have been W–E across the Hazara or Nanga Parbat areas. It would also have been helpful to extend line "E–F" (the northern section) into Kaghan and Neelum valleys to overlap more with the middle section. Additionally, the lines of section could have been indicated on the mosaic key. The editors have, perhaps wisely, not drawn the northernmost section deeper than 5–10 km below sea level. It is with the drawing of cross-sections that one assumes the editorial input has been strongest. A 'round robin' cross-section is rarely practical ("your bit goes here"), so it is disappointing that an absence of structural measurements on the map leaves the reader in a poor position for criticism of the sections. For example, the evidence for the blind thrust structures in the Salt Range is unclear. Large faults receive "thrust, normal or wrench" classification and antiformal and synformal axial traces (plunge direction) are sometimes shown. Without outside knowledge there is little room for re-interpretation in what should be the most thought-provoking part of any map; hence here the editors must be believed blindly. Perhaps local stereoplots could have used the space occupied by Searle's tourist photographs, possibly keyed to specific parts of the map.

The overall impression of the map is that it is an orphan, or somewhat anonymous. There is neither a date nor a publisher's name in some familiar corner. The anonymity prevails in the lack of accompanying text; i.e. the highly-misplaceable guidebooklet to which we have become accustomed. Such a text could have been used to introduce the geology of areas and basic histories concisely. For example, ideas for protoliths seem essential in such areas of polymetamorphism. Here, the editors might have expressed degrees of certainty or acknowledgment of controversy over particular structures, locations of contacts, or ages of units. Here, references for geochronological ages, preferred interpretations, popular alternatives and even the "also rans" would find a good home, and much of the anonymity would be dispelled. Indeed, there may have been the space for a stereoplot or some other presentation of measurements leaving more opportunity for the 'draw your own' cross-section. The limited text is reserved for the shopping list of rocks types, mineral assemblages and formation names; all likely of little use to general readers of this journal. It is then maybe unclear for whom the map is

intended. The uninitiated may be turned away by the lack of any introductory text leaving readers to fend for themselves here in the murky depths of the Himalayan syntaxis. This may be good, in that there is a danger some may regard the map as definitive state of knowledge. It certainly is not, bearing in mind its omissions and necessary judgement in disagreements over observations.

Despite all these criticisms, I wish to take nothing away from the excellent initiative displayed by the editors. They have produced a highly-impressive first canvas that captures much data hitherto scattered amongst desks of Europe, the U.S.A. and Pakistan. The map therefore will provide a good starting point for questions, arguments, revised maps, and most obviously, a return to the field. Any compilation is subjective and, as here, can involve a strong editorial hand. It is the discerning eye of the reader that must be critical. I would strongly recommend this map for workers in the Pakistan (or other) Himalaya for whom it can serve as a framework. It is certainly a nice colourful map that I will put on the wall to be rapidly marked by comments, changes and sketches, helping the next version to roll from the press.

REFERENCES

- Fontan, D. and Schoupe, M. (1995) *Geologic Map of Neelum Valley, Azad Kashmir (NE Pakistan)*, scale 1:50 000.
 Greco, A. and Spencer, D. A. (1993) Geological map of the Himalayas of NE Pakistan (Hazara–Kashmir synaxis). In *Himalayan Tectonics* eds P. J. Treloar and M. P. Searle, Vol. 74, pp. 224. Special Publication of the Geological Society, London.
 Greco, A., Martinotti, G., Papritz, K., Ramsay, J. G. and Rey R. (1989). The Himalayan crystalline nappes of the Kaghan Valley, NE Pakistan. *Eclogae Geologicae Helveticae* 82/2, 603–627.
 Searle, M. P. (1991) *Geology and Tectonics of the Karakoram Mountains*, J. Wiley and Sons, Chichester, U.K.
 Wadia, D. N. (1931) *The Syntaxis of the Northwest Himalaya: Its Rocks, Tectonics and Orogeny*. Records of the Geological Survey, India. 65/2.

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Geology for all

J. L. Dickey, 1996. *On The Rocks: Earth Science for Everyone*. John Wiley & Sons, U.K. 252 pp. £12.99 (Paperback).

I think this a very welcome book. Its sub-title, "Earth Science for Everyone" is too modest. The book rather amounts to an introduction to science for everyone. Here, of course, the approach is through questions about the Earth. We are shown that the examination of a historical science provides an antidote to the view that science pretends to provide infallible answers to problems posed. It is made evident that often we do not possess the data we should like to have. We see too that it is not enough when attempting to explain historical events merely to throw general laws at them (Frodeman, 1995). Geological science is not just the sum of the physics, chemistry etc. deployed.

The text is arranged in twelve chapters. The first is entitled "Gathering stardust" (Dickey is a meteoritic man). The succeeding seven chapters are concerned with atoms, crystals and rocks, melting, metamorphism, and Earth structure. The ninth tackles questions of the supply of energy and raw materials, as well as the disposal of radwaste. The concluding chapters introduce the reader to the Earth as a planet. Equations appear where they usefully sum up the matters concerned. The need for the stringent testing of hypotheses is a constant issue.

Through an essentially historical approach to a historical science, the very human nature of the enterprise is made clear. Hypotheses are children of their time. Failure is as likely an outcome of enquiry as success. The part that argument through analogy plays in historical science is illustrated. Uniformitarianism, the most famous example, naturally is discussed, and Lyell's unwillingness to face the awkward question of a start to Earth history noted. Perhaps Dickey could have usefully added here that Kelvin in 1868 published a fierce condemnation of this weakness of what he termed "British popular geology"