How dangerous is this fault?

Krinitzsky, E. L. and Slemmons, D. B. (editors) 1990. *Neotectonics in Earthquake Evaluation.* Reviews in Engineering Geology, Volume VIII. Geological Society of America, Boulder, Colorado. Price $37.50 (hardback).

If a book is aimed at a readership whose interests are different from those of the subscribers to the specialist journal in which the book is being appraised, the reviewer is faced with a dilemma. Should he or she pass judgement solely on the basis of how well the book serves the needs of its target readership, or should he or she concentrate on what the book has to offer the journal's subscribers? If the first viewpoint is correct thinking, I guess that the engineer would like an unambiguous answer to the imaginary question used as a title to this piece. I doubt whether an answer about the individual faults under investigation will be forthcoming from this book, but it will give the engineer a very good idea of the uncertainties involved, and the multidisciplinary character of neotectonics. Will the book excite the structural community? I rather doubt it. This is not because the articles it contains are of poor quality but because many of the ideas discussed have been well aired before, often by the same authors who have contributed to this volume.

Neotectonics in Earthquake Evaluation comprises seven chapters, an index and a very brief Foreword. The editors state in their foreword that the papers in the book "provide guidance for geological assessments of earthquake hazards throughout the contiguous United States". Other than that statement, they do not explain why certain topics were emphasized while others were omitted. For example, there is no chapter on the San Andreas fault zone. Why? Did an author fail to deliver, or did the editors conclude that it has, in the past, been given more attention than it deserves.

I particularly enjoyed Chapter 1, *Estimation of earthquake size for seismic hazards*, by C. M. dePolo and D. B. Slemmons. They explain clearly what is meant by terms or phrases such as: 'characteristic earthquake', 'maximum earthquake', 'segmentation technique', 'earthquake-size–fault-rupture-length relations', and 'logic trees'. The authors approach their theme in a logical manner which highlights the multitude of methodologies that are available to an investigator wishing to assess the seismic hazard of a region. As befits an overview article, the authors select their examples from a broader base than just the U.S.A., although collisional terranes are somewhat neglected.

In Chapter 2, K. J. Coppersmith and R. R. Youngs discuss seismic hazard in the Pacific Northwest; that is, the Cascadia region of the U.S.A. and Canada, not the northwest side of the Pacific. The distinctive feature of their chapter is a discussion of "probabilistic analysis using expert opinion"—a nice piece of jargon, and a phrase worth remembering for use in grant applications. The authors show that if you ask experts for their advice it pays off, especially if their opinions are sought independently of each other.

A. C. Johnston and S. J. Nava write about *Seismic-hazard assessment in the central United States* in Chapter 3. This intraplate region, and especially the area around New Madrid, is nearly (at least before the 29 June 1992 M7.4 Landers [CA] earthquake) exciting as much interest in the U.S.A., as is California. I especially appreciated the integration of material about the contemporary state of stress into a discussion of regional structure and seismicity.

The seismic potential of the Meers fault (Oklahoma) is the subject of Chapter 4 by A. R. Ramelli and D. B. Slemmons. Like the preceding chapter, this one also emphasizes intraplate activity, but focuses on the Meers fault; a structure expressed by a remarkably straight, 40-km-long scarp on which there is clear evidence for there having been late Holocene displacement. The use of half tones to illustrate the morphology of landforms was a good idea, and one employed only in this chapter and Chapter 7. The authors conclude that late Quaternary faults with low rates of activity have "the potential for larger magnitude events than previously believed".

The eastern United States, another region not associated with earthquake hazard in many people's minds, is the subject of Chapter 5 by P. J. Barosh. The chapter is a long review which is profusely illustrated by line drawings, some of which are, however, rather crudely drawn, and clearly taken without redrafting from a variety of sources; mainly Barosh's own papers. Readers of this journal will be pleased to know that the importance of understanding the structural geology of a region when assessing the seismic potential is regarded as essential.

P. Talwani's theme in Chapter 6 is also the eastern United States, but this time the focus is on the Charleston area where the great 1886 earthquake occurred. How to search for a variety of palaeoseismological clues, in the absence of exposed seismogenic faults, is carefully explained; as is the importance of appreciating the seismotectonic framework of an area.

The final chapter, by C. M. Menges, on neotectonic fault scarps, mountain-front landforms and fault segmentation is concerned with phenomena in the Sangre de Cristo Mountains, New Mexico. The author deals with a relatively small area (by the standards of most other chapters) but the concentration on particular phenomena makes his observations more immediate. A correlation between fault scarp height and vertical offset is established, and the occurrence of a wide scale range of fault segments is well documented.

If you are concerned with the applied aspects of neotectonics you should read this collection of papers. Many of them contain examples of phenomena and/or relationships that can be employed to illustrate and enliven a course; for which a more comprehensive text is still awaited.

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Sandbox modelling of faults—two films

Analogue Modelling of 1: *Extensional Fault Structures* and 2: *Inversion Fault Structures.* 1991. VHS cassettes produced by Geofilms Ltd for BP Exploration Operating Company Ltd., available from 12 Thame Lane, Culham, Oxford OX14 3DS, U.K. Price £150 each plus £6 p&p.

These films commissioned by BP are based around the work of Ken McClay and his group at Royal Holloway and Bedford New College, University of London. They demonstrate the application of scaled sandbox experiments to the structural interpretation of fault geometry. Each film lasts approximately 30 minutes.

Analogue Modelling 1: Extensional fault structures

By way of introduction, Dr Vingoe (BP) considers the problems encountered by geologists and geophysicists in interpreting seismic profiles and rightly concludes that analogue modelling is more easily appreciated by most workers and students than mathematical modelling.

Using time-lapse photography the film records the results of five models selected from the work of Ken McClay's group. The strength of the models lies in their accurate scaling of the geology and use of appropriate materials to simulate brittle deformation of the crust. The machinery is described, although the choice of deformation rate and footwall geometry are not explained, which might leave an unfamiliar viewer wondering why these particular parameters were chosen. Likewise the filling to regional base level by syn-rift sediment (different coloured sand in the models) cannot be assumed, but the implications are not discussed. However, these and other issues might be taken up as points for discussion in, for example, an undergraduate seminar.

The first model uses a simple listric fault and as the model is extended (with the amount of extension clearly noted) the nature and order of faulting and key features, such as a crestal collapse graben, are indicated.

Model 2 uses a similar listric fault but with a dipping detachment and illustrates the development of two crestal collapse grabens either side of a stable horst. Both planar and listric faults develop and the geometries of the faults are seen to alter with continued extension. An unfaulted segment is seen adjacent to the main fault. The models are compared to seismic profiles which is useful although might have been a little more credible for any sceptics, had the interpretation been built up slowly; e.g. by initially identifying the faults, followed by outlining of the various sediment packages.

Model 3 uses a ramp–flat geometry and the result of this change in footwall geometry is clearly seen with the development of a ramp syncline and a highly rotated section over the flat suggesting reverse faulting and fold development are to be expected in this situation.