solve the Navier–Stokes equations for incompressible mantle flow associated with continental rifting. These models suggest that the development of significant small-scale convection in the asthenosphere and lower lithosphere below a rifted solid upper lithosphere is more dependent upon rift geometry that rate of rifting. Such convection affects the subsidence history and the volume of melt produced from the decompression of the upwelling mantle material. This conclusion differs from that of Bown and White, who give a very clear review of the relationship between rifting, melting and subsidence. They argue for four controls: Beta factor; potential temperature; initial lithospheric thickness and duration of rifting. Subsidence is affected by the volume of melt produced because the combination of igneous rock produced plus the depleted mantle residue is less dense than the initial mantle source rocks.

These models assume pure shear and agree well with both non-volcanic (Galacia Bank) and volcanic (Rockall Plateau) margins in the north Atlantic region. Bott presents an analysis of the tensile stresses associated with rifting. He demostrates that such stresses are due to the thermal anomaly beneath rifts and to subduction on opposite sides of the plates. More subdued extensional stresses can originate from the abrupt weakening of the lithosphere at the newly formed plate boundary. Watts and Marr estimate the strength of margins using the gravity anomaly associated with sediment loading. "Strong" margins exhibit a long wavelength, single edge effect anomaly, whilst "weak" margins show a shorter wavelength, double edge effect anomaly whose symmetry is affected by the strength of the oceanic lithosphere. This model applied to the east coast of the USA argues for a weak continental margin which is not related to hot-spot activity, whilst weak African margins are probably influenced by proximity to hot-spots.

The next papers discuss north Atlantic margins of Norway (1 paper), Greenland (2 papers), USA (1 paper) and Iberia (5 papers) and the structure of the Atlantic crust (1 paper). Svrivastava and Roest argue that the SW Greenland margin is bounded by thin crust that is of problematic nature. Seismic evidence has suggested that it is continental, but the magnetic signatures suggests oceanic crust formed before Chron 30. Carbonell *et al.* use seismic anisotropy to estimate the mineralogy of the deep crust and identify a zone of magnetic underplating above the Moho in SW Greenland. New deep seismic data from the Norwegian margin presented by Skogseid and Eldholm support a late Cretaceous–early Palaeocene rifting event associated with voluminous vulcanism and melt emplacement.

A review of the EDGE experiment along the eastern US seaboard by Talwani *et al.* suggests that basaltic seaward dipping reflectors cause the East Coast Magnetic Anomaly. The single polarity of these mafic rocks suggest rapid sub-aerial spreading associated with a very high rate of magma production. A model is presented of an intially sub-aerial spreading ridge that subsequently subsided. The Atlantic is traversed with a discussion by Danobieta *et al.* of the similar seismic characteristics of ocean floor developed on either side of the Mid Atlantic Ridge Chron 16, a time when the spreading rate halved. There then follows a substantial section on the Galatian margin including papers by Sibuet *et al.*, Boillot *et al.*, Krawczyk and Reston, and Torne *et al.* Oceanic crust occurs west of the Peridotite Ridge, whilst thinned continental crust exists to the east. The 'S' reflector, at about 12–8 km depth within this thinned crust may represent a major shear detachment where, at least immediately east of the Peridotite Ridge, the upper plate continental crust has detached from its basement and during break-up been emplaced onto an oceanic basement. Numerical modelling of this margin suggests that here the OCB is 115 km wide.

The final part of the book covers a variety of subjects. Vegas *et al.* report on the structure of the South Scotia Ridge, comprising crustal fragments transported eastwards from the South America–Antarctica isthmus and the Bramsfield Trough, a half graben behind the South Shetland arc. The Moho underlying the Valentia Trough along the Mediterranean Iberian margin is mapped by Vidal *et al.* using stacked wide-angle seismic sections. Ergun *et al.* attribute the Marmara Sea basin to strike-slip pull apart associated with post-Eocene movements on the Anatolian fault system. A detailed account is given by Mascle *et al.* of the Côte D'Ivoire–Ghana transform margin where the ocean–continent transition occurs over just 5 km juxtaposing 20 km thick continental crust against 5 km thick oceanic crust. The Pacific margins are only represented in the final two papers by Kinoshita and Hirata and Kurashima which discuss the Japan Sea Basin. The opening of this back-arc basic in the Miocene may have been associated with ophiolite emplacement and it is presently underlain by thinned continental crust in the south and oceanic crust in the north.

Many of the articles in this book are well written and often contain concise and informative reviews of the topic discussed. It is a must for any researchers concerned with ocean–continent boundary process, and oil company geologists, especially in view of the new interest in deeper water basins. It is also valuable for those geologists who study ancient continental margins. Although the book tends to concentrate on the Atlantic, the variety of margin types described provide a salutary lession to those, like myself, who try to reconstruct ancient margins using a simple template. This is a good book; I enjoyed it.

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Asian tectonics

Yin, A. and Harrison, T. M. (editors) 1996. *The Tectonic Evolution of Asia*, Cambridge University Press. 666 + xii pages. Price £125 (US$200). ISBN 0-521-48049-3

This volume is a complilation of presentations made at a conference (Rubey Colloquium) held at UCLA in February 1994. An eclectic range of topics on the general theme of the conference title are included in the 21 papers by 67 authors. A particular distinction, and one of the most valuable aspects of the volume, are reviews and synthesis of existing data and ideas, well-presented, and giving a good idea of current understanding, and containing excellent sources of references to the original papers. However, there are plenty of new, original data and ideas in this volume too. All papers were reviewed externally, and the volume shows other clear signs of careful editing; specifically that the figures are reproduced at adequately large size, that labels on them are all explained, and that there is an amazing rarity of typographical errors in the text.

The book is divided into several sections, starting with geodynamic models of the Cenozoic deformation. This section contains one of the usual suspects, a good review of the thin viscous sheet model for collisional lithospheric thickening, including some geometric modifications. The other paper in this section, by Kong and Bird, which uses a thin shell finite element model containing the major faults, is a new, and ambitious development. Structural geologists may be interested among other things in a firm conclusion predicted by the model that the (numerous) large faults all must be very weak.

The second section is on Seismotectonics. This contains two papers with new data based on highly precise earthquake locations and their first motions. One covers the western Sunda/Burma Arc, the other includes, among other far-distant parts of Asia, discussion of earthquakes in the Indian continent, including a possible nascent thrust indicated by a deep earthquake in the upper mantle beneath the present position of the Main Boundary Thrust. A third paper in this section reviews results from seismic tomographic techniques on mantle structure beneath Asia.

Part 3 contains four papers on the geological development of the Himalaya and Karakorum. Here, in particular, are papers that are of value as up-to-date reviews. One by Patrick Le Fort covers the mountain system as a whole, and gives a good up-to-date overview by a single author who has worked in the chain for many years and who has seen close-up most of what he is talking about. There is also a wide-ranging compilation of isotopic age and metamorphic P–T–t data for Himalaya–Karakorum and (for what little there is) the rest of Tibet, too. Others besides myself might take issue with this author's claim (and grammar) that the Nyainqenthangla is a 'completely unique' structure in Tibet; while this part of the Yadong–Gulu rift is oblique to the overall northerly trend of the other segments, the structural kinematics are the same, as shown by the excellent studies of Armijo, Tapponnier, Mercier and Han. Another good paper in this section integrates metamorphic and isotopic age data for the northwest Himalaya, Kohistan–Ladakh, and the Karakorum, with particular attention to the relations and timing of assembly across the MKT and MMT fault boundaries between them. Lastly, there is a really useful synthesis of the Himalayan foreland basin, with a somewhat revised timescale applied to the magnetic reversal stratigraphy. While one might not accept the suggestion that the Indus fed the Ganges during part of the late Miocene, this is a superbly illustrated and well-written paper, and is the place to go if you want to find out what is known in the basin.

The next section entitled Tectonics of the Cenozoic Indo–Asian collision contains my choice for the best paper in this volume and, coincidently, the one perhaps of most interest to structural geologists. This is the paper by Thomas, Cobbold, Wright, and Gapais on the Cenozoic Tectonics of the Tadzhik Depression. Its appeal is that it integrates a wide variety of data types, including core elements of structural geology at both small and large scale, into a new and highly convincing overall model. This section also contains a useful synthesis of results from the Ailao Shan Red River shear zone, and a reconnaissance report on paleostress results from eastern Tibet.

The final section in the book contains papers on the Mesozoic and older geology of Asia. Two summarise different viewpoints on the ultra-high pressure metamorphic rocks and their setting in the Qinling–Dabie Shan, one concentrating on the metamorphic aspects, the other on the geology and the isotopic ages, but this does not contain any detailed reports on the structural geology of the occurrences. Another paper reviews the Songpan-Ganzi flysch as a paleo-Bengal Fan related to the Qinling Shan collision zone, adding some detailed observation evidence in support of this familiar concept. There are also papers on Mesozoic wrench tectonics in Korea and Japan, possibly related to the late stages of the Qinling collision and the Tan Lu fault, and, another of interest to structural geologists, a very well-documented study of a Cretaceous low-angle detachment and metamorphic core complex in the Yunmeng Shan, near Beijing. Another paper integrates Triassic and Jurassic paleofloral gradients, and using very carefully selected paleomagnetic poles, shows that the floral changes follow the latitudinal motion of the Asian continent. There is also a tectonic updating from Turkey, somewhat revising Sengor's Paleo- and Neo-Tethyan history of who did what, to whom, and when. There is also a paper integrating the tectonic history of China and neighbouring regions for the whole Phanerozoic; this ambitious undertaking provides a useful summary for those unfamiliar with the geological history of China (including Tibet and Xinjiang) but, in an article of reasonable length, it cannot help somewhat uneven treatment of different areas and events.

Finally, at the back, like a Russian doll, this book contains another book, namely 154 pages on the Paleotectonics of Asia by Sengor and Natal'in. This article alone would be justification for a research library to purchase the volume, since there is nothing like it anywhere in the published literature and, whatever you may think of the interpretations, it provides access to information and references on the geology of a huge, remote and (outside the FSU) poorly known region of the continent.

This volume is one that should definitely be in all university libraries serving geoscience departments, particularly because it contains new information and ideas about the Indo-Asian collision, and collision tectonics in general. All researchers active in the field of the Indo–Asian collision, and those who seek to understand the older tectonics of central and eastern Asia, will want to have a copy readily available. This is, however, not an essential item for the personal library shelf of structural geologists working elsewhere.

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Out of Africa

Scholz, C. 1997. *Fieldwork—A Geologist's Memoir of the Kalahari*. Princeton University Press, New Jersey. Price: $24.95, £19.95. ISBN: 0-691-01226-1.

This book arrived on my desk for review in JSG, just as I was packing up for a week's fieldwork in Scotland. I took it with me to take a look, and decide about its review; but once I had begun to read it, there was no turning back. By the time Jack Treagus had dipped into it, too (sparking reminiscences of his year spent in West Africa), the book was much handled, and in no state to pass on to another reviewer. So this preamble is the Editor's confession of selfishness in keeping an interesting book for myself! My only excuse is that, for once, I was doing fieldwork rather than desk work; and what better book to take for evening reading than Chris Scholz's *Fieldwork*?

This is not the usual kind of book that arrives for review in JSG. It is not a text book, nor a research tome, nor a collection of papers. It is autobiographical, but written in a lively and provocative style: the memoirs of a relatively short period in Chris Scholz's career, but one that clearly altered many of his perceptions of science and life. This lifts the book away from what might have been a rather straightforward account of a research enquiry, into a book that sometimes reads more as a novel, capturing places and events vividly. The year is 1974, when Chris and his friend and technical collegue at Lamont, Teddy Koczynski, engaged in two months of fieldwork in Botswana, hitherto a barely-heard-of spot on the map of Africa for them.

The approach came from the United Nations Food and Agriculture Organization (UNFAO), inviting Scholz to be an earthquake consultant for the UN Development Programme in the Okavango delta, Botswana. He would probably have declined the offer, but for natural curiosity; plus some rapid investigation showing there were indeed recent earthquakes in this region, hinting that the east African Rift might extend further south than formerly described. Chris talked Ted into joining him to undertake field-based seismic surveys in the region, with the support of the Botswana Geological Survey. What the FAO expected the two Americans to do was not very clear, but Chris hoped that the visit might answer some of his burning questions regarding continental rifting, faults and earthquakes. The scientific results were eventually published in science journals. This is the human account: what happened, what they did, how they felt. Such is the skill in writing that I felt it was a privilege to be sharing these experiences.

It would spoil the book for potential readers if I told all the best bits here. Sufficient to way that our two intrepid Americans found many culture shocks, even before they arrived in Africa: European bureacracy in Rome, where they appeared to be unexpected; travel arrangements onwards to Africa, more complicated than could be imagined. Already chastened, they then received a dose of the snobbishness and misplaced values of the old British Empire. We then read of the frustrations of being delayed in the start of their fieldwork and seismic surveying: all that time spent whiling away the hours in bars! Life finally hots up for the lads, as at last they go into the field, develop working and living arrangements with the Survey and their staff, encounter elephants and other wildlife, and manage to avoid collecting new wives along the way. Scholz's vivid writing captures the culture shocks that came with this expedition, but is written sensitively and makes no boasts of heroism.

Some readers might wonder why, and for whom, this book was written. In all memoir-writing, there will be a degree of catharsis for the writer, and in some cases one might ask what is there of interest for the reader? In the case of this book, we have an unusual mix that might not have worked: but I think it does. I am not sure that a non-geologist, without any understanding of plate tectonics or faulting, and with no geographical interests, would choose to read it. But all geologists, not just those whose speciality is structure and tectonics, should be enthralled. One could nitpick a little, and wonder why the only two illustrations (maps) were presented as preface figures. This required the fussy reader, trying to work out where our explorers went, to keep turning back; nor am I sure that all the places were on the two maps. But this was a brave and successful attempt *not* to make this text-bookish, based on learned detail and diagrams. It is flowingly written, and with humour; so perhaps it was better to tuck the maps in at the front, without making them intrusive.

You will have to read it for yourself to discover whether Chris and Ted fulfilled their obligation to the UNFAO, and at the same time, answered their own questions about whether the East African Rift was still actively rifting and propagating in the Okavango region. True adventure stories do not necessarily have 'happy endings', and perhaps this was an experience more like a beginning than an ending. Twenty-three years have elapsed since they undertook *Fieldwork*, over which time this part of Africa has hugely changed, and Chris Scholz and colleagues have continued their research in earthquakes and faulting, published in conventional ways (including in this Journal). The magic of this book is that it provides us with a rare glimpse of what goes on behind the scenes in research: which in this case takes us into deepest Africa.

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