

velocities and attenuation help constrain those rheological properties. Internal heterogeneities of the Earth on a range of scales and their geodynamic implications, as exemplified by conclusions from relatively recent developments in seismic tomography and seismic anisotropy, are discussed in some detail.

Of course, a significant proportion of the material covered by this book can be found scattered about elsewhere. But its greatest value lies in the drawing together of traditional topics together with more recent developments such as the thermodynamic aspects of rock deformation and links with whole-Earth geodynamics. This is combined with a clear writing style and excellent illustrations to make this an essential addition to a researcher's bookshelf.

E. H. Rutter

#### Reference

PATERSON, M. S. & WONG, T.-F. 2005. *Experimental Rock Deformation: the Brittle Field*, 2nd ed. Berlin: Springer, 348 pp.

DAWSON, J. B. 2008. *The Gregory Rift Valley and Neogene–Recent Volcanoes of Northern Tanzania*. Geological Society Memoir No. 33. viii + 102 pp. London, Bath: Geological Society of London. Price £65.00, US \$130.00; GSL members' price £32.50, US \$65.00; AAPG/SEPM/GSA/RAS/EFG/PESGB members' price £39.00, US \$78.00 (paperback). ISBN 978 1 86239 267 0.  
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This Memoir effectively summarizes the truly remarkable and visually spectacular volcanic province in northern Tanzania toward the southern end of the Gregory Rift or eastern branch of the East African rift system. In this volume the author provides an accessible summary of the geology, including information on the underlying structure, as the setting for a description of the volcanoes and their petrology and geochemistry. In this part of northern Tanzania there are a relatively large number and variety of volcanoes, generally quite young (Late Miocene to the present), ranging from basaltic shield volcanoes to stratovolcanoes, the latter composed mainly of pyroclastics. These are found in the half graben that extends south of the well-defined Kenyan part of the eastern rift. In northern Tanzania the volcanic area continues for over 100 km to the east, where the large Meru and Kilimanjaro volcanoes are found, in what is called the North Tanzania Divergence. Notably, the summit of Kilimanjaro is the highest point on the African continent, and is built by the products of three overlapping shield volcanoes.

The volume is a synthesis of research in the region over many years by the author, of course also drawing on other people's work where appropriate. It is an invaluable addition to the geological literature as it provides an authoritative summary of this region, which contains so many unusual, even unique rock types. Although the volcanism is dominated by basaltic activity, mainly quite alkaline and undersaturated in character, there are more fractionated rocks, including trachytes, phonolites and comendites. But, in addition, at Oldoinyo Lengai, alkali carbonatite magmas are found in

this presently active volcano. Among the many other notable volcanoes in the region is Ngorongoro, a shield volcano with a very large caldera.

Dawson effectively sets the scene by providing a thumbnail sketch of current plate motions in East Africa with the Somali plate moving away from the Nubian plate, creating the East African Rift that extends from the triple junction in the Red Sea–Gulf of Aden region through Ethiopia and Kenya into northern Tanzania. Very extensive volcanism is associated with these extensional zones in Ethiopia and Kenya, initiated in the north in Eocene times, but with continuing activity to the present day. The author provides a brief and most interesting chapter on the history of discovery of the African rift valleys and their geological significance. The dramatic and youthful rifting evident in northern Tanzania is well described, although the adjacent shelving boundary between the Tanzania Craton crystalline basement rocks and the younger Mozambique Fold Belt is not regarded as exerting a major controlling role.

Following a synthesis of relevant geophysical data together with a description of the tectonic development of the rift structures and the associated sedimentary basins, including reference to the sediments at Olduvai that have produced so many important hominid fossils, the author presents a comprehensive summary of the Neogene–Recent volcanism of the region, the main topic of the Memoir. For the serious investigator as well as the more casual geological visitor to the region, summaries provided of the individual volcanoes, their character, composition and thoughts on their genesis are invaluable guides. As mentioned above, Oldoinyo Lengai, which is a youthful stratovolcano displaying a classic cone, is unique because it is the only active volcano in the world producing carbonatitic lavas. The main part of the volcano comprises altered nephelinitic and phonolitic pyroclastics, with lava flows also present. Following a period of dormancy, nephelinitic lavas and pyroclastics were produced, some interbedded with natrocarbonatitic ashes and flows from the northern crater, where carbonatitic lava pools occur. Dawson reviews the various ideas as to the origin of the natrocarbonatitic magmas.

The volume is well illustrated with geological maps, photographs, tables of representative chemical analyses of volcanic rocks, as well as figures showing some of the voluminous geochemical data available. Colour photographs of several of the volcanoes and photomicrographs of some of the rocks enhance the volume. In reviewing the geochemistry of the volcanic rocks, Dawson presents persuasive evidence that the bulk of the magmas, whether basaltic or carbonatitic, originate from the upper mantle, and that any assimilation of continental crustal material is minor or absent.

The few typographic errors found in the text do not detract from the good quality overall in the production of the volume. The author is to be congratulated in giving the geological community a very useful reference guide to this intriguing region and its volcanism. The volume ends with a number of pointers toward answering the many remaining questions on the origin and evolution of this part of northern Tanzania, and also provides a useful listing of the isotopic ages that have been measured on the Neogene volcanic rocks from the region.

Ian McDougall