

hydrous experiments too easily. That said, they have done a good job in collating the existing data. *Komatiite* is a good 'Wikipedia' start for graduate students interested in the early Earth, and petrology in general, provided some guidance is at hand.

Maarten de Wit

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JANIS, C. M., GUNNELL, G. F. & UHEN, M. D. (eds) 2008. *Evolution of Tertiary Mammals of North America. Volume 2: Small Mammals, Xenarthrans, and Marine Mammals*. viii + 795 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £150.00 (hard covers). ISBN 9780 521 78117 6. doi:10.1017/S001675680900630X

Comprehensive reviews of the Cenozoic fossil mammal fauna are unfortunately few and far between. This new volume is the second and final instalment in a truly masterful compilation of North America's non-Pleistocene Cenozoic mammals. Like its predecessor, it will prove an indispensable overview of the relevant groups, and the new taxonomic appraisals, written by leading experts on the groups concerned, make it an essential research tool for students of the respective groups.

Volume I covered terrestrial carnivores and ungulates, as well as all groups ecologically similar to these animals. A lot of ground was left to cover: the rodents, insectivores and other small mammals – jokingly referred to as the 'vermin' in the introduction – as well as the xenarthrans and other 'edentates', and finally the marine mammals. Given the size, scope and vast amount of data included in both volumes, it seems remarkable that the entire project was originally conceived of as a single volume. Ten years after the publication of Volume I and about 20 years after the first contributions were received (!), the efforts of 35 contributors have brought completion to the project.

Introductory chapters review the morphology, biology, phylogeny and biogeography of all the major groups. While these reviews focus on the North American fauna, they have broad appeal given that accessible syntheses of mammal phylogeny and diversity are uncommon (and few of us own and know all of the primary literature). The characteristic cranial and postcranial characters are discussed and genera are reviewed individually: information is provided on their characteristic features and, where appropriate, taxonomic content is reviewed. An addendum chapter includes numerous updates for Volume I.

The book is well illustrated throughout with cladograms, diagrams of bones and teeth, and life restorations. The life restorations represent a great improvement on the choice of illustrations used in Volume I, many of which were (in my opinion) poor and cartoon-like. However, there are obviously fewer of them in the present book. This is partly because the artist for many of Volume I's illustrations was no longer available, but – so explain the editors – it's also because life restorations do not exist for many of the groups included.

That might have been the case for, say, eomyids or fossil squirrels, but it most certainly does not apply to such groups as aplodontoids, palaeonodons or xenarthrans.

Finally, one problem does afflict this volume, and this is the same problem that troubled so many with the appearance of Volume I. Namely, the price. While some individuals might be prepared to fork out the tremendous amount required for this volume (£150), most researchers will have to consult the copy owned by the university library...or rely on reprints.

Darren Naish

Reference

JANIS, C. M., SCOTT, K. M. & JACOBS, L. L. (eds) 1998. *Evolution of Tertiary Mammals of North America. Volume 1: Terrestrial Carnivores, Ungulates and Ungulate-like Mammals*. Cambridge, New York, Melbourne: Cambridge University Press, 691 pp.

KARATO, S.-I. 2008. *Deformation of Earth Materials. An Introduction to the Rheology of Solid Earth*. x + 463 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £45.00, US \$90.00 (hard covers). ISBN 9780 521 84404 8. doi:10.1017/S0016756809006323

Deformation of Earth Materials by Shun Karato is a welcome addition to textbooks dealing with experimental rock mechanics and its application to natural rock deformation. It complements the recent second edition of Paterson & Wong's book (*Experimental Rock Deformation: the Brittle Field*), by dealing with ductile rock deformation mechanisms, and provides by far the most comprehensive and authoritative treatment of this field in recent years. It is squarely aimed at graduate students and researchers, although some advanced undergraduates will also find it a useful source. Karato is a leading expert in experimental rock deformation applied to mantle processes and the volume leans that way, to the extent that particular aspects of deformation in the continental crust are not covered, such as deformation–metamorphism relationships and flow of partially molten crustal rocks. On the other hand, much of the material is sufficiently general to be of interest to scientists working with either environment. Its value to students is enhanced through the incorporation of problem exercises at many points throughout the text and the volume is supported by a very comprehensive list of some 1500 original references.

The book provides a brief introduction to essential background material, such as stress, strain and elasticity, relevant thermodynamics (including defect chemistry, essential to appreciating the role of water in plastic flow of rocks), phenomenology of continuous deformation (including issues of stability and flow localization into shear zones).

The role of intracrystalline defects in plastic flow is summarized. The theories of flow by dislocation glide and dislocation creep are set out, plus creep by grain-size-sensitive processes such as diffusive mass transfer and grain boundary sliding. The influence of solid-state phase transformations on flow is reviewed along with the development of crystallographic preferred orientation during flow. All of these are supported and illustrated by reference to experimental data, mainly on ultrabasic rocks.

The final third of the book is devoted to aspects of the application of theoretical and laboratory mechanical studies to geodynamics. This section summarizes the composition of the Earth and how this impacts on the rheology of the interior, and how deformation of the surface and study of seismic

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/EFM/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