

BOOK REVIEWS

Annual Review of Earth and Planetary Sciences, 2018. Raymond Jeanloz and Katherine H. Freeman (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 46. xii + 580 pages. Price: US\$ 112.

The plate tectonic theory had spawned a paradigmatic shift in the way we address issues related to the Earth's evolution. And, the momentous 1960s ushered a new dawn in Earth sciences under the auspices of a group of scientists across the Atlantic. Standing tall among them was Dan McKenzie from the Cambridge University, UK. His paper along with R. L. Parker on 'Tectonics on a sphere' marked a watershed moment in Earth science research. In the inaugural article of this volume McKenzie writes about his eventful scientific career – highlighting his contributions on lithospheric structure, mantle convection and plate motion.

The ramifications of plate tectonic convergence and orogenesis of various geologic time slices continue to be the focus in several other articles in this volume. Royden and Faccenna review the insights gathered on the mountain-building processes in the Mediterranean region. Rosenbaum presents the understanding gained on the extension, contraction and magmatism of Tasmanides – the eastern half of Australia that was in the Phanerozoic, a part of Gondwana's eastern plate margin. Şengör *et al.* go into the intricacies of the protracted evolution of the Altai – the largest mountain chain in Central Asia.

Some articles focus on the lower crust – a *terra incognita* even today as access is granted only through the exhumed basements. Dumond *et al.* review the current understanding of the granulite terrain of Athabasca in Canada – an exhumed deep continental basement. Manning evaluates the role of fluids and their interaction with rocks at the lower crust. As we go deeper into the centre of the Earth, the constraints available are still weaker. Williams focuses on the current understanding and the outstanding questions on thermal conductivity under extreme conditions of the core.

Human activity is now generally recognized as a force to reckon with in generating hazards related to climate. But it may come as a surprise to some

that it is also capable of generating earthquakes. In fact, the induced seismicity emerged as a serious issue in India back in 1967, when a large quake occurred around the dam in Koyna, western Maharashtra. But dams and their role in inducing the earthquakes are just one part of the story. Keranen and Wein-garten write about the earthquakes caused by fluid injection in petroleum fields. In another article, Uenishi emphasizes the interaction of higher frequency waves (wave propagation in the Earth, atmosphere and the structures themselves) with low frequency waves (below 1 Hz) that could result in seemingly unusual earthquake destruction patterns. Albright *et al.* take stock of the usefulness of satellite imagery in the detection of many secret related nuclear weapon facilities and how they have become a touchstone for formulating sound international policies on nuclear non-proliferation. One of the case studies also includes how the satellite images helped in the detection of India's secret gas centrifuge facility for enriching uranium, located in Mysuru.

The sediment strata built up over geological timescale have always been used by geologists as an archive of climatic conditions that prevailed during their deposition. But its value as an archive

diminishes if the records are incomplete. This incompleteness has been attributed primarily to erosive processes. Paola *et al.* contend in a somewhat 'unorthodox' manner that the gaps in sedimentation in fact represent the 'actuality' of lack of deposition rather than any erosion-dependent removal. Berhe *et al.* explore the vital role of soil erosion in the mobilization of carbon, nitrogen and phosphorus that is ultimately crucial in activating the geochemical cycles (photosynthesis, redox potential, carbon sequestration, etc.) and regulating the climate. Unlike other planets like Mars, where life probably germinated but ended without much ado, the Earth continued to be an active crucible of early life because the production of oxygen continued unabated, facilitated by the rise of photosynthesis. The rise of oxygen was more than a simple single event; it was a complicated event spread over billions of years. The cyanobacterial mats through their ecosystems contributed substantially in influencing oxygen production in the early Earth. Dick *et al.* examine the various possible scenarios such as effects of light availability, redox geochemistry, microbial metabolism and other biological controls on the protracted oxygenation processes.

Another major area of research in Earth sciences has been the questions



This Google Earth snapshot shows the areas of the globe the Institute for Science and International Security monitors frequently using satellite imagery. The labelled locations are featured as case studies in this article.

related to fluid circulation in the oceans and atmosphere. In the context of global change and warming climate, these questions have acquired further importance. Ma *et al.* look at how a warming climate changes the atmospheric circulation in the tropics and how it is going impact rainfall in those regions. That such research is vital for the countries like India, where vagaries of the monsoon do not need a reality check anymore. Coogan and Gillis outline the present understanding of the low-temperature advection of sea water through upper oceanic crust ('off-axis' hydrothermal circulation), and the feedback systems that modulate ocean chemistry and its impact on climate. Ferreira *et al.* examine how the Atlantic deep-water formation is impacted by different climate states. It is now known that some planets like Venus, or Titan, the moon of Saturn exhibit phenomena like super-rotation with respect to the circulation of winds and fluids that move 60 times more than the planet itself. This has become a huge challenge to the modellers, and serves as the topic of discussion in an article by Read and Lebononois.

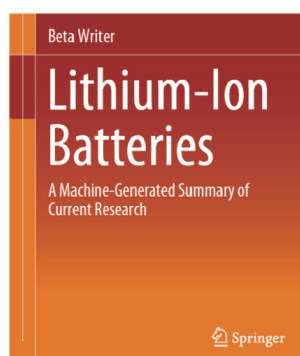
Environmental factors are major drivers in evolutionary patterns and processes. As in previous volumes, this collection also showcases such articles. The proboscideans (mammoth), ancestors of modern elephants had to deal with the warming high latitudes. Fisher finds evidence for their diet and the then existing environmental conditions from the analyses of preserved soft tissues and tusks of their specimens. One of the articles in this category discusses the evolution and divergence of seals, walrus and sea lions based on fossil evidence. First seen in the Oligocene, major pinniped divergence occurred in the Neogene. How did the improvement in sensory capabilities provide evolutionary advantages to the Palaeozoic amniote vertebrates? Müller *et al.* examine this question.

This volume has little representation from planetary sciences. Except for an article regarding super-rotation on Venus and Titan, there are hardly any papers on planetary sciences compared to three articles on evolutionary or palaeobiology, which should have been more appropriate for the *Annual Review of Ecology, Evolution, and Systematics*. As a reader, I would expect more representative reviews on the processes that make our planet 'endlessly dynamic', along

with the exciting developments in the planetary sciences. The present volume, however, does not disappoint us as it showcases scholarly reviews on some of the intriguing questions in Earth and planetary sciences.

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Lithium-Ion Batteries: A Machine-Generated Summary of Current Research. Beta Writer. Springer Nature Switzerland AG, Gewerbestrasse 11, 6330 Cham, Switzerland. 2019. xxxv + 247 pages. Price: 51,99€. ISBN 978-3-030-16800-1 (eBook).

The title of this book, at the outset generates curiosity and excitement in the minds of all type of readers – generally interested in science and engineering – although most may not have any knowledge regarding machine intelligence or battery technology. The so-called virtual author Beta Writer holds the mysterious key, as what is depicted here is a joint attempt between Springer Nature and researchers from Goethe University Frankfurt, Germany. The primary objective is to develop an algorithm for a machine-generated book on lithium (Li)-ion batteries due to its contemporary importance (e.g. electric vehicles), and also due to a highly crowded multidisciplinary research. Li-ion batteries have captured the interest of the whole world due to impressive developments in the last few decades not only in innovative materials in terms of performance parameters like

capacity, long cycle life, fast charge-discharge rate and environment-friendly operation, but for automated battery maintenance software technology also for sustaining human mobility. However, my first impression is disappointment and a negative perception, and I hope my little knowledge in batteries and more specifically on the status of Li-ion battery research might not be the culprit. In any case, the general expectations arising from such a seductive title are not met despite the explicit statement in the introduction that this book could serve the reader as a platform for defining the current status of the technology. Further, the claim about providing an overview on the latest trends of Li-ion battery research is not justified, except perhaps providing a veritable cornucopia of materials under various chapter titles in a protracted manner with plenty of avoidable repetitions and ambiguous linkages. Ironically, the second part of the book title actually bails out the criticism to some extent as one cannot intuitively expect a cogent and interconnected description unless human brain intervenes. The application of similarity-based clustering routine is mainly responsible for the lack of coherence in chapters and sections and to some extent, the needlessly stretched text in every chapter and the lack of succinct summaries in the conclusion sections. In contrast, meaningful and enjoyable texts have been completely generated by machine intelligence in many cases of film scripts, music, fiction, market reports, sports, weather forecasting, etc. and judging by the level of complexity, one could, of course, be optimistic to rectify all limitations in subsequent refined versions.

The book has a long preface (by Henning Schoenenberger) providing the background behind the automatic generation of 'meaningful' research text using machine learning. The system architecture and implementation details are provided with the help of a flow chart in order to indicate the transparency in text generation and extractive summarization. The narration has, however, an apologetic undertone, not in a strident way, but in a subtle manner in describing all details of machine processing. For example, when 53,000 articles are scanned (but not understood) with respect to certain keywords related to applications, the nature of input decides the outcome and a minor variation can have disastrous