

deltaic and fluvial, signifying gradual retreat of the sea towards the end of Oligocene. Rift tectonics is discussed, but an important omission is a reference to the Eocene Hinge Zone in the Bengal Basin.

The Andamans represent a zone of active subduction and back-arc spreading. A comprehensive summary of the lithostratigraphy, structural architecture and geodynamic scenario is presented in chapter 21. Logically this chapter should come immediately after chapter 19, because the Andaman subduction and Himalayan subduction are two facets of the same plate motion.

The Indo-Gangetic Plain is the cradle of ancient Indian civilization. It represents a foredeep basin formed about 1.5 million years ago. The sediment fill, subsurface structure, physiographic development, changes in drainage course, delta development, tectonism and climate changes are described in chapters 22 and 23. The Quaternary geology of the shield and the coastal belts are also covered. There is an interesting discussion on civilization shifts in the Harappan and Vedic times in relation to drainage and climate change. From the paucity of human fossils in the Indian Quaternaries, Valdiya rightly raises the following question: Did humans evolve outside the Indian subcontinent and enter as an evolved species of *Homo sapiens*? The discovery of *Homo erectus* and an archaic form of *Homo sapiens* from the Narmada valley is significant in this respect. Rigorous study of the Quaternary cover is somewhat neglected in India. It is to be appreciated that Valdiya has elucidated (chapter 24) the history of the Quaternary uplift (1–6 mm/yr) in the Himalaya as recorded in the geomorphology, drainage changes, river ponding and active faulting. The tectonism was accompanied by climate change and the two together played an important role in controlling human settlements, a prolific record of which is preserved in the Himalaya and western India. The course and history of human migration to India, which would be of interest to the general readers is briefly dealt with. Chapter 25 contains an excellent discussion on active faulting and seismicity not only in the Himalaya but also in the stable continental region. The importance of GPS studies and regular monitoring is stressed.

Chapter 26 deals with a topic that is not usually covered in Indian geology

textbooks – the ocean floor topography, geology and geodynamics of the Indian Ocean, Arabian Sea and Bay of Bengal. Coastal sediments as well as the Bengal Fan and Indus Fan are also described. Valdiya's effort is laudable because the oceans are not only the locales of potential future mineral and energy resources, but are also important from the global geodynamics point of view.

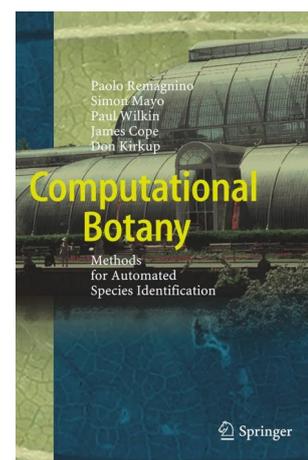
Chapter 27 is the grand finale, a resume of the preceding chapters; it outlines the evolution of the Indian subcontinent from 3.5 Ga to Recent.

Two topics that are included in the discussion of each geological terrane, (a) an outline of the evolution of life through time traced through the description of life forms in each time-slot, and (b) the mineral assets, would be of interest to all readers. The book is profusely illustrated by well-drafted maps and sections, which have added to the value of the book; however, editorial lapses have led to a few mismatches between caption and illustration. The references are exhaustive and would be useful for researchers, but some recent works have not been quoted and there are a few important omissions, e.g. the seminal paper on Charnockite Formation by Janardhan *et al.* (*Contrib. Mineral. Petrol.*, 1982, **79**, 130–149), the Rajasthan crustal evolution paper by Kaur *et al.* (*Precambrian Res.*, 2011, **187**, 155–164), the North Singhbhum Mobile belt paper by Mahato *et al.* (*Precambrian Res.*, 2008, **162**, 102–107), the zircon dating work by Ghosh *et al.* in the Southern Granulite Terrane (*Tectonics*, 2004, **23**, TC3006), and the review of Himalayan tectonics by Yin (*Earth Sci. Rev.*, 2004, **76**, 1–131). A frustrating experience for me was the absence of an Index, which makes it extremely difficult to navigate through the book, or to locate a particular topic.

Overall, this is an excellent book on Indian geology in all its aspects, and would be extremely valuable to students and researchers. The publishers may consider bringing out a cheaper paperback version, so that it becomes more accessible to students and young researchers for whom this book is meant.

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Computational Botany: Methods for Automated Species Identification.

P. Remagnino, S. J. Mayo, P. Wilkin, J. Cope and D. Kirkup. Springer-Verlag, Heidelberger Platz 3, 14197 Berlin, Germany. 2017. viii + 114 pages. Price: 112,14 € (Hardcover). ISBN 978-3-662-53743-5.

Technological development is revolutionizing the world. There are certain aspects of plant science that have got new impetus through the advent of computers, digital photography, image analysis and many other tools. For instance, L-systems based plant modelling¹, plant genomics, image analysing for anatomists, etc. are some of the outcomes of this. Identification of plants has always been an important and fascinating area for botanists. However, there is a decline in the prominence given to taxonomists, which has subsequently reduced the number of taxonomical experts across the globe². Even though biotechnological tools provide accurate identification of plant species, these procedures are tedious, laborious and costly. Therefore, morphological-based plant identification is usually adopted.

The progress in digital photography and image analysing techniques has made automated plant identification possible. The first author of this book Paolo Remagnino is not a botanist by profession; he is a professor at the School of Computing and Information Systems, Kingston University, London. Similarly, the second author is also from a computer science background. The other authors are botanists from the Royal Botanic Gardens, Kew. So, this book is a laudable outcome of an interdisciplinary research collaboration. There are many

papers and books dealing with automated species identification and the first chapter elaborates it explicitly with valid references. In this chapter, the authors justify the need for the development of computational methods for species identification and also reveal the objective of the book. They highlight thrust areas where computational botany is making a commendable contribution, such as the AMAP studio for plant architectural modelling³.

A botanist uses a wide range of key determinants or taxonomical databases for identification of plants. However, computational botany considers leaves as one of the key descriptors. The reason for selecting leaves as a prime source is explained in the first chapter of the book. Rather than discuss it here, let us move on because this chapter is designed to invoke the curiosity of the beginners. With leaves becoming the basis for automated plant identification, there is a meticulous explanation of the concept of morphometrics for the beginners to maintain the pace for the other chapters.

Often, students bring a large collection of samples for the herbarium as well as photographs during field studies. They refer to digital herbaria and monographs for identification. Sometimes, there will be a debate on the identity of a species. For example, if one refers to an unknown species leaf shape as obovate or oblong, disagreements would generally appear. This book points out that the conventional identification usually depends on qualitative parameters, which at certain times may not be accurate. Thus, there is a need to find better descriptors when it

comes to automated identification. Chapters 2 and 3 deal with existing techniques for leaf shape analysis. These chapters may not arouse the interest of a botanist as they deal with some mathematical computation. The contents are explained in detail. Further, some botanists may neglect chapter 4 as it deals with algorithms that are used in plant leaf analysis. However, we feel that young researchers must pay special attention to this chapter because it explains the possibilities of using morphometric parameters coupled with computer capabilities in identifying a plant species. Thus, chapter 4 explains how the computations are processed and executed in a simple manner.

The last chapter of the book explains a complex algorithm. Authors attempt to understand the difference in perception between a botanist and a non-botanist regarding a leaf specimen. With the help of figures, the authors compare the views of botanists and non-botanists to find most appropriate plant identifiers. With an aim to reveal the most effective algorithm for automated identification of plants, the authors highlight the need of using a large number of filters to achieve a high level of accuracy. Although the authors have demonstrated the possibility of an automated identification of plant parameters, a lot of work needs to be done before real-time utilization.

Finally, we must mention that this is a highly specialized book that does not have to be a mandatory source for all plant scientists. However, it is an important source in the development of highly automated approaches of plant identification. It will be helpful for young res-

earchers to understand the latest computational tools and principles on which these are developed. Also, one of the benefits of this book is that it provides information on the basics of automated identification in a simplistic manner compared to the recent study of Lee *et al.*⁴. Thus, this book is an important contribution for students and researchers in plant science as well as computational botanists.

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3. Fourcaud, T., Zhang, X., Stokes, A., Lambers, H. and Körner, C., *Ann. Bot.*, 2008, **101**, 1053–1063.
4. Lee, S. H., Chan, C. S., Wilkin, P. and Remagnino, P., In Image Processing (ICIP), 2015 IEEE International Conference on IEEE, Quebec City, Canada, 2015, pp. 452–456.

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