Society of Earth Scientists Series

K.S. Valdiya

The Making of India

Geodynamic Evolution

Second Edition

The Society of Earth Scientists 2008

Springer

Society of Earth Scientists Series

Series editor

Satish C. Tripathi, Lucknow, India

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ISSN 2194-9204 ISSN 2194-9212 (electronic)
Society of Earth Scientists Series
ISBN 978-3-319-25027-4 ISBN 978-3-319-25029-8 (eBook)
DOI 10.1007/978-3-319-25029-8

Library of Congress Control Number: 2015950897

Springer Cham Heidelberg New York Dordrecht London
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2nd edition: © Springer International Publishing Switzerland 2016
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Printed on acid-free paper

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To My revered teacher
the late Shri Shiva Ballabh Bahuguna
who showed me the path
I have walked on.

Preface from Series Editor

The Indian subcontinent is a coveted destination for geologists owing to its unique geological set-up involving some of the oldest cratonic blocks up to the youngest Quaternary sequences. The oldest cratons—Dharwar, Bastar, Singhbhum and Bundelkhand—represent cratonization process at ~3 Ga and their mosaic forms the Peninsular part of India. The intervening Proterozoic mobile belts and sedimentary basins add another dimension to the varied geology of India. Record of the earliest form of life has been extensively studied. The term "Gondwanaland" has its origin from India. After its break-up, Greater India moved northward rapidly as an island cut-off from rest of the globe supercontinent. The collision and subsequent subsidence of Indian subcontinent with Asia gave rise to the great Himalayan Mountain Ranges—the youngest fold–thrust belt. The vast tract of Indo-Gangetic alluvium as Himalayan foreland basin bears evidence to the voluminous extent of Quaternary fluvial sedimentation. As such, Indian subcontinent offers "food for thought" for geoscientists world over working in different domains.

The book *Making of India: Geodynamic Evolution* by veteran geoscientist and teacher Prof. Valdiya is a wonderful compilation of Indian geology, wherein he has included large number of references including those published but not noticed. The limited published copies of the first edition of the book were sold within a very short span of time, ran out of print and could not meet the demand. Sensing the great demand for the book Prof. Valdiya thoroughly revised and updated the content of the book. When approached, The Society of Earth Scientists immediately accepted to publish it under SES Series with Springer as an International edition for its worldwide circulation. I apologize for delay in bringing this voluminous book to print due to several parallel engagements but hope it will fulfil the need of the students and researchers.

Satish C. Tripathi

Preface to the Second Edition

Within two years of publication of the book *Making of India: Geodynamic Evolution* in 2010, all copies were sold out. Still there was a great demand for the book and I was receiving calls for availability of the book. I felt that my object of distilling substance from stupendous volume of literature published in 65 years after independence, and weaving through the maizes of conflicting contentions of field workers and researchers, and presenting commonly acceptable viewpoints had met with success. So I updated the book, citing additionally more than 350 new works, and corrected mistakes, some inadvertent some my own, related mostly to year of publication of research papers.

The publisher of the first edition of the book M/S Macmillan Publishers India Ltd. discontinued publication of all higher-education text books in science. It took me quite sometime to find a willing publisher—in *The Society of Earth Scientists*. Dynamic and extraordinarily dedicated that he is, Honorary Secretary and Series Editor Dr. Satish C. Tripathi presented me with amazing dispatch a thoroughly reprocessed and altogether reformulated the manuscript.

Hopefully this updated edition will be well received by readers, primarily students, teachers and researchers for whom I have written this book.

I am profoundly grateful to Dr. Satish C. Tripathi, to The Society of earth scientists and to Springer International Publishing Switzerland. But for the crucial and tremendous help of Dr. Kanchan Pande, Professor of Earth Science, Indian Institute of Technology, Mumbai, this edition would not have come out. Dr. Jaishri Sanwal also lent her great help.

K.S. Valdiya

Preface to the First Edition

The seed of the idea of writing a book on the geology and geodynamic evolution of the Indian continent was planted in my mind years ago when Mrs. D.N. Wadia asked me to revise that superb work of D.N. Wadia—*Geology of India*. I had to decline. I wrote back stating that the expansion of geological knowledge has been so vast, and so many advances in our understanding of the geodynamic processes involved in the evolution of the crust had taken place in last few decades that rewriting rather than revision of a book on the geology of India was called for. In 1996, the then President of the Geological Society of India Dr. B.P. Radhakrishna called me telephonically to suggest that I write a text book on the geological history of India. Being inextricably preoccupied with neotectonic study of the Mysore Plateau, I hummed and hawed but waited for a formal letter, which did not come. In early 2003, when the Indian National Science Academy offered, without my asking, the Golden Jubilee Research Professorship, I made up my mind to embark upon the venture of writing an account of the geological setting and tectonic history of the Indian continent. The focus was to be India, but the surrounding regions would have to be brought in the ambit to portray the whole picture of the evolution of the southern part of the Asian continent.

The wonderfully great works of D.N. Wadia, M.S. Krishnan and E.H. Pascoe amply bring out the contributions of pioneers and giants of the pre-Independence time. I have chosen to base my accounts on the works of mainly those who explored the land of India after 1947. Exception has been made in the case of the Himalaya province where comprehensive regional studies started quite late—a decade or a little earlier before India's independence. Endeavour has been made to bring out the works of those silent geologists whose contributions have gone and remain "unhonoured and unsung".

Encompassing broad array of information related to structure and tectonics, stratigraphy and palaeontology, sedimentation and palaeogeography, petrology and geochemistry, geomorphology and geophysics, the book presents in a concise format a simplified and coherent story of the evolution of the Indian continent. Effort has been made to integrate what little I know, desisting, however, from dwelling

on arguments related to controversies (although calling attention to them), curtailing details of methodologies and descriptions, pack no more than is necessary for understanding and avoiding using jargons of stratigraphic nomenclature. Presented in a distilled form, the observations and deductions of workers on different facets of earth science, this book is intended to provide appreciation of the geological developments taken place in the making of India. A comprehensive though selective list of original works would provide lead to those who seek details and wish to go into the depth of problems. No more than an updated guide, this book is meant for readers who wish to enlarge their scientific perception.

Curtailing unnecessary details without making them shallow and updating without being unsympathetic to the past contributions, the diagrams are designed to depict settings and situations rather than precise delineation of geological features.

While writing this book, words of my mentors reverberated in my mind. My college-day teacher Shri Shiva Ballabh Bahuguna used to exhort me to see the world around with wide open eyes and try to know about as many things as possible. "The outcrop is the final court of appeal where all concepts or theories must the tested" wrote Prof. F.J. Pettijohn in 1974. And to have a close look at the outcrops, one must go "out among the rocks" was the message Prof. W.D. West gave me in 1991. Fortunately, I have lived and worked all my life among the rocks in different parts of India—the central sector of the Himalaya, the eastern extremity of the mountain arc, eastern Vindhyachal, northern Bundelkhand, the Mewar region of the Aravali, the Mysore Plateau and the central and southern Sahyadri. The voyages of studies enabled me to carry out "conversation with rocks", which gave me insight and some understanding of the natural phenomena involved in the making of India. I wish to share that understanding with students and teachers of geology and non-specialist readers.

K.S. Valdiya

Acknowledgments

I am deeply grateful to Prof. M.S. Valiathan, the then President of the Indian National Science Academy and to the members of his Council, for enabling me to write this book by offering the Golden Jubilee Research Professorship.

Words cannot express my feeling of gratitude to Jawaharlal Nehru Centre for Advanced Scientific Research for very generous support and immeasurable help to make me pursue the project the way I wanted.

A large number of friends have helped me to prepare the draft of the book, Dr. Anshu Kumar Sinha, then Director of Birbal Sahni Institute of Palaeobotany (Lucknow), Director Dr. V.P. Dimri, Librarian Shri B.M. Khanna, and Scientists Ravi Prakash Srivastava and Ashutosh Chamoli of National Geophysical Research Institute (Hyderabad), and Library Assistant Surendra Singh Bhandari at Wadia Institute of Himalayan Geology (Dehradun) greatly helped me in getting the relevant literature.

Professor Kanchan Pande (Indian Institute of Technology, Mumbai), Dr. Rajeev Upadhyay (Kumaun University, Nainital) and Dr. S.S. Bhakuni (Wadia Institute of Himalayan Geology, Dehradun) extended invaluable help to get the original drafts of diagrams finely redrawn by dedicatedly competent artists Shri S.S. Sawant, Shri G.C. Kothyari and Shri V.N. Ghoshal. Shri C. Vedamurthy ably set the typescript in a proper format and prepared the list of references. Shri Mohan Singh Bisht and Dr. Pradeep Goswami (Kumaun University, Nainital) helped me in innumerable ways. I do not know how to thank these friends.

I am profoundly grateful to Prof. Mallickarjun Joshi (Varanasi), Prof. Kanchan Pande (Mumbai), Prof. R. Vaidyanadhan (Cuddalore), Prof. Vishwas S. Kale (Pune), Dr. D.K. Paul (Kolkata), Dr. U. Raval (Hyderabad), Dr. M. Ramakrishnan (Chennai), Dr. V.N. Vasudev (Bangalore), Dr. M. Jayananda (Bangalore), Prof. C. Srikantappa (Mysore), Prof. R.S. Sharma (Jairpur), Dr. T.M. Mahadevan (Kochi), Dr. S. Sinha-Roy (Jaipur), Prof. N.C. Ghose (Bangalore), Dr. Fareeduddin (Bangalore), Prof. C. Leelanandam (Hyderabad), Prof. Somnath Dasgupta (Kolkata), Dr. T.K. Biswal (Mumbai), Prof. R.K. Lal (Varanasi), Prof. Anand Mohan (Varanasi), Prof. Asru Chaudhuri (Kolkata), Dr. R. Dhana Raju

(Hyderabad), Prof. Naresh Kochhar (Chandigarh), Dr. Jokhan Ram (Dehradun), Dr. V.C. Thakur (Dehradun), Prof. B.N. Upreti (Kathmandu), Dr. O.N. Bhargava (Panchkula), Dr. Anshu K. Sinha (Gurgaon), Prof. S.K. Shah (Secunderabad), Prof. S.M. Casshyap (Noida), Dr. R.C. Tewari (Aligarh), Prof. K.V. Subbarao (Hyderabad), Prof. S.F.R. Sethna (Mumbai), Dr. Hetu C. Sheth (Mumbai), Dr. S.K. Biswas (Mumbai), Prof. Ashok Sahni (Chandigarh), Dr. H.M. Kapoor (Lucknow), Dr. Rajeev Upadhyay (Nainital), Dr. S.K. Acharyya (Kolkata), Prof. S.K. Tandon (Delhi), Dr. A.C. Nanda (Dehradun), Prof. P.K. Saraswati (Mumbai), Dr. A.T.R. Raju (Kakinada), Prof. M.S. Srinivasan (Varanasi), Prof. V. Sharma (Delhi), Prof. Brahm Parkash (Roorkee), Prof. Rajiv Sinha (Kanpur), Dr. D.D. Joshi (Lucknow), Prof. L.S. Chamyal (Vadodara), Prof. Ashok Singhvi (Ahmadabad), Dr. Amal Kar (Jodhpur), Prof. S.M. Ramasamy (Tiruchirappalli), Dr. R.K. Pant (Ahmadabad), Dr. J.R. Kayal (Kolkata), Dr. C.P. Rajendran (Trivandrum), Dr. K.S. Krishna (Dona Paula) and Dr. M.V. Ramana (Dona Paula) for critically and painstakingly going through chapters of the book and making extremely valuable suggestions for improvement.

K.S. Valdiya

Contents