Preface

Microstructure, texture and mineralogy provide crucial clues regarding the evolutionary history of a rock. An atlas documenting the petrographic and mineralogical details of common rock types is integral to the understanding of physico-chemical conditions of magmatic, metamorphic and sedimentary processes of rock formation for both beginners and advanced researchers alike. Complex processes involved in the development of a variety of rock types at convergent plate boundaries and continental collision zones make a fascinating subject for discussion among earth scientists. But a comprehensive account of texture and mineralogy of rocks from such a tectonic setting is currently lacking. This book attempts to fill that gap.

The idea of creating a petrographic atlas occurred to the senior author Naresh C. Ghose in the late 1970s while supervising the research projects of three Ph.D. candidates—R. N. Singh, O. P. Agrawal, and M. P. Shrivastava—in the newly discovered Naga Hills Ophiolite (NHO) belt at the eastern continental margin of India. Early investigations carried out over a decade in this virgin and challenging terrain were aimed at establishing the geology, stratigraphy and classification of rocks. Despite limited funds and lack of instrumental facilities, two books—"Ophiolite and Indian Plate Margin" (1986) edited jointly by Dr. Ghose and S. Varadarajan, and "Phanerorozoic Ophiolites of India" (1989) edited by Dr. Ghose—were published. These books are considered to be among the first of their kind on the application of plate tectonics in the study of ophiolite sequences from the Indian continental margin.

This book emerges from an intensive study of the eastern part of the India-Eurasia collision zone by the authors. It deals with a segment of the oceanic lithosphere that originated under the Neotethys Ocean in Late Mesozoic. The lithospheric segment was emplaced within the accretionary wedge of the subduction zone where the Indian plate subducted below the Myanmar (Burmese) microplate. Remnants of the lithosphere are now exposed as ophiolite along the suture zone where India and Eurasia collided to form the Himalayan Mountain Range at the northern margin and the Indo-Myanmar Range (IMR) at the eastern margin of India in Early Eocene. Detached outcrops of ophiolite are exposed all along the IMR. The ophiolites in the northern part of IMR in the Indian states of Nagaland and Manipur are known as the NHO. The fascinating tectonic history of the Naga Hills, wide variety of lithological assemblages, seismic activity and mineral resources associated with the mantle-derived ophiolitic rocks have received global attention for intensive research in recent years.

As the surface manifestations of the oceanic lithosphere, ophiolites serve as natural museums for studying the three-dimensional characteristics of the earth's oceanic crust and upper mantle. However, because of incomplete preservation and alteration, the crust and upper mantle in ophiolite formed at convergent plate margins present a major challenge in characterizing the oceanic lithosphere. About 1,200 thin sections of rocks from the ophiolite suite collected across the NHO by the three aforementioned Ph.D. scholars and Dr. Ghose were re-examined between 2008 and 2012 for the preparation of

this atlas. The black-and-white field photographs of the inaccessible Tizu gorge section are supplied by O. P. Agrawal, who led an expedition in the region in the late 1970s.

This book is an outcome of the integration of collective ideas of the authors. Dr. Ghose and Fareeduddin collaborated to acquire and interpret the optical photomicrographs, Nilanjan Chatterjee acquired the Backscattered Electron (BSE) images, and Nilanjan Chatterjee and Dr. Ghose interpreted the chemical data obtained with the Electron Probe Microanalyzer (EPMA). Each chapter has been reviewed by experts in different disciplines to streamline the text. The book focuses on rocks typically associated with ophiolite including metamorphic peridotite (tectonite), cumulate mafic-ultramafics rocks of the layered sequence (peridotite-pyroxenite-gabbro-plagiogranite-anorthosite), volcanic and volcaniclastic rocks of mid-oceanic ridge origin, zeolite-prehnite and greenschist facies metamorphic rocks of the ocean floor, blueschists and C-type eclogites associated with convergent plate boundaries, pelagic sediments, and syngenetic (podiform chromitite, platinum and gold) and epigenetic (nickeliferous magnetite and Cu–Mo sulfides) economic minerals. Photomicrographs of rocks and field photographs showing mutual relationships are representative of the structure, mineralogy and petrology of the NHO rocks. Optical photomicrographs and BSE images of magmatic, metamorphic and sedimentary rocks, and associated economic mineral deposits are systematically presented. We hope this book will generate interest among beginners and professionals in the field of ophiolite research and facilitate better understanding of the chain of events regarding the origin and emplacement of ophiolite.

This book adopts a simple approach by creating a 'pictorial representation of ophiolite' to study the complex processes of its formation. Descriptions of myriad events affecting the oceanic lithosphere from the time of its birth to its emplacement on the continental margin are never complete. Every effort has been made by the authors to capture accurately the different facets of the problems related to the ophiolite. As in any major endeavour and given the vast magnitude of the subject matter discussed in this book, expectations may fall short of target. The lead author (Naresh Chandra Ghose) takes full responsibility for any shortcomings in the presentation and interpretation.

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