Preface

Structural geology is the study of deformation features in rocks from microscopic to map scale. The required data are collected in field and supplemented by laboratory studies, aerial photographs, satellite imageries, and subsurface data (mostly obtained by geophysical methods). A geologist must explore an area with an open mind and interpretations and hypothesis must be based on actual field observations. Any evidence, however small, contradictory to a popular belief or hypothesis must not be ignored and should be taken into account in the final interpretation. Geophysical investigations are useful but some of the techniques are based upon certain assumptions that allow alternate explanations for the same data, in many cases. One such example can be cited from the Himalaya where deep seismic sounding (DSS) studies were performed under an International Geodynamic Project and investigations were carried out along the Tien Shan-Pamirs-Karakoram-Himalaya geotraverse. A number of lithospheric sections were drawn and these sections show very well-marked steep or vertical faults that reach to a depth of ~90 km and displace the Moho (Kaila et al. 1978). However, later subsurface sections that emerged after popularization of the thin-skinned thrust tectonics model illustrate a marked basal decollement with a number of splay thrusts (Allegre et al. 1984). The maximum possible error in case of dip measurements can be 90° and that can be seen in the available sub-surface sections!

Recently, a problem has cropped up because of the modern evaluation system of measuring the quality of research. A certain scale is definitely needed to measure the importance of scientific contributions but with increasing importance of certain Indexes and factors, a negative trend is emerging. Field observation or laboratory data, which is contradictory to a widely accepted hypothesis is sometimes ignored by researchers to be in the frontline of research. It must be kept in mind that because of the heterogeneous nature of the earth's crust, different stress conditions, and different temperature–pressure conditions during deformation, structural evolution of each area is unique and each hypothesis must be modified with additional parameters to highlight this uniqueness. It is really painful if field data is fit into a particular theory of tectonics without considering the possible alternatives. One of the objectives of the present book is to bring out the limitations of some of the modern concepts, related interpretations and propose an alternate model for evolution of the Himalaya.

In the modern times of super specialization, a field geologist may not be very well conversant with certain aspects of recent developments in a particular topic. This has been observed especially in case of the Himalaya where fieldworks have been done mainly for understanding the regional stratigraphy and structure. The problem is aggravated by absence of continuous rock exposures (especially in the NE Himalaya) and lack of sub-surface data for most of the regions. Hence the cross-sections are approximate and can be extrapolated to fit into a previously conceived model. Since there are several aspects in earth sciences that cannot be proved for want of suitable data, it is always better to work with multiple models so that with gradual increase in database, the final model can withstand the test and verification from different approaches.

Structural evolution of the Himalaya is largely attributed to collision followed by subduction of the Indian plate below the Tibetan plate. The model explains large-scale tectonics of the region but while doing so some of the important structural features, e.g. the early rift phase in the Himalayan region, occurrence of younger rocks on the thrust hanging wall, superposed deformation, etc., are ignored by many. The history of Himalayan evolution does not initiate from the Tertiary but from the Proterozoic when the normal listric faults initiated during the rift phase. Relicts of some of these faults can be observed in older rocks.

The object of the book is to provide structural evolution of the Himalaya with relevant basic information so that earth scientists of other specializations will find it easy to comprehend. Hence the book is divided into two parts. Part I describes the basic principles of structural geology and Part II describes the structural evolution of the Himalaya. The book is not intended to be a substitute for an undergraduate coursework because many of the structural geology topics (e.g. joints, unconformities, plotting of field data, etc.) have not been incorporated. However, the book can be used as a supplementary teaching aid.

Dehradun Ashok Kumar Dubey

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