PREFACE

Structural and tectonic account of Manipur is still far from complete and probably, it is in its infancy state. The present work, "Structural and Tectonic Analysis of Manipur with Special Reference to Evolution of the Imphal Valley" is, therefore, devoted to provide a comprehensive but short structural and tectonic framework of the region specially in regard to the deformation and evolutionary mechanisms of the state and that of the Imphal Valley.

The thesis introduces with a generalised account about the people, location and accessibility, climate, flora and fauna of the state. A brief discussion on the topographic features and the drainage systems, and their subdivisions have also been included in this introductory chapter beside the usual review of previous works, objectives and methodology of the present work. The second chapter deals with the study of geological succession and description of the major lithounits of the state. It is observed that older lithounits exposed on the eastern side, generally overthrust the younger ones exposed on the western side of the state. Field setting suggests that all these units lean one over the other dipping towards east forming an imbricate thrust system. Such a structural and tectonic setting is found to have resulted from the subduction of the Indian plate below the Myanmar plate.

In chapter 3, analysis of structural and tectonic lineaments has been conducted statistically from which the regional compression (WNW-ESE) and extension (NNE-SSW) vector components have been evaluated. All the structural elements are found to occur as if developed under a fairly uniform stress field. A strain ellipse is constructed based on the analysed stress data to examine the deformation mechanism of the region. A simple shear or shear couple deformation model, in conjunction with the evolution of the Indo-Myanmar Range (IMR), seems to best explain all the structural and tectonic features present in the state. Plate kinematics and interactions
worked out in chapter 4 reveal that microtectonics plays a very important role in the
deformation and evolution of the region. Computation of plate motion vectors using
rotation vectors calculated by different workers indicates that the NE Indian plate
motion relative to the Myanmar (Burma) plate (sVl) is directly responsible for the
evolution of the state and this can also account for all the tectonic constraints of the
region.

Analyses of streams, conducted in chapter 5, show close compatibility with
the structural and tectonic lineaments of the region. Besides, classic drainage patterns
displayed by various drainage systems, systematic change and variation in the
frequency of stream occurrence is also found from the eastern side to western side of
the state. All these features are closely related to the deformation mechanics of the
structural elements controlling the streams. As in other parts of the world, thrust
zones are generally characterised by transverse to oblique drainage systems which is
found to be due to excessively high normal stress (S3) on these thrust planes.

Minor structures of the Imphal Valley and its adjoining region analysed in
chapter 6 provide certain typical fold geometry of the region. Although, angular and
narrow hinge nature is the common geometry of the folds, angular synforms and box
shaped antiforms as well as angular antiforms, broad and rounded synforms are also
found commonly in different parts of the state. Systematic development of the
fractures, compatible to that of the lineaments, also suggests their possible common
mechanism of genesis. Paleostress analysis employing conjugate fractures indicates
nearly constant orientation of the minimum principal stress (S3) in the NNE or SSW
direction revealing possible stretching of the rocks of the valley in the same direction.

Generalised tectonic description of Manipur state and that of Northeast India
including its gravity and seismic accounts are provided in chapter 7. An evolutionary
model of the region, devised in terms of an accretionary prism of an island arc type
convergence is also included in this section. Estimation of crustal shortening, parallel
to the tectonic transport direction, provides a value of about 48%, giving rise to
113Km of shortening across the state. Calculation of crustal stretching, parallel to the
tectonic extension direction, in the Imphal Valley, reveals a stretching factor ($\beta$) of about 1.25 to 1.77 i.e. 25 to 77% extension indicating a possible extension of the valley by about 15 to 34Km.

Taking into consideration, all the factors discussed above, an evolutionary model of the Imphal Valley (Basin) is envisaged in chapter 8 of this work. It is found that a transtensional or pull-apart basin best exemplifies the evolutionary model of the valley. It is also found to be a thin-skinned, cold basin that evolved in the later phase of the IMR tectogenesis as a function of the dextral strike-slip faulting along the pre-existing thrust planes. Testing and confirmation of such a model proposed here may, however, be made with precise subsurface data only.

The structural and tectonic accounts provided in the present work may not be complete in itself. So, it is quite inevitable that with more data being accumulated, the ideas given in this work may be improved, modified or altered in the near future. However, the framework provided in this volume may form a basic foundation for future research in the field of structural geology and tectonics of Manipur state.

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