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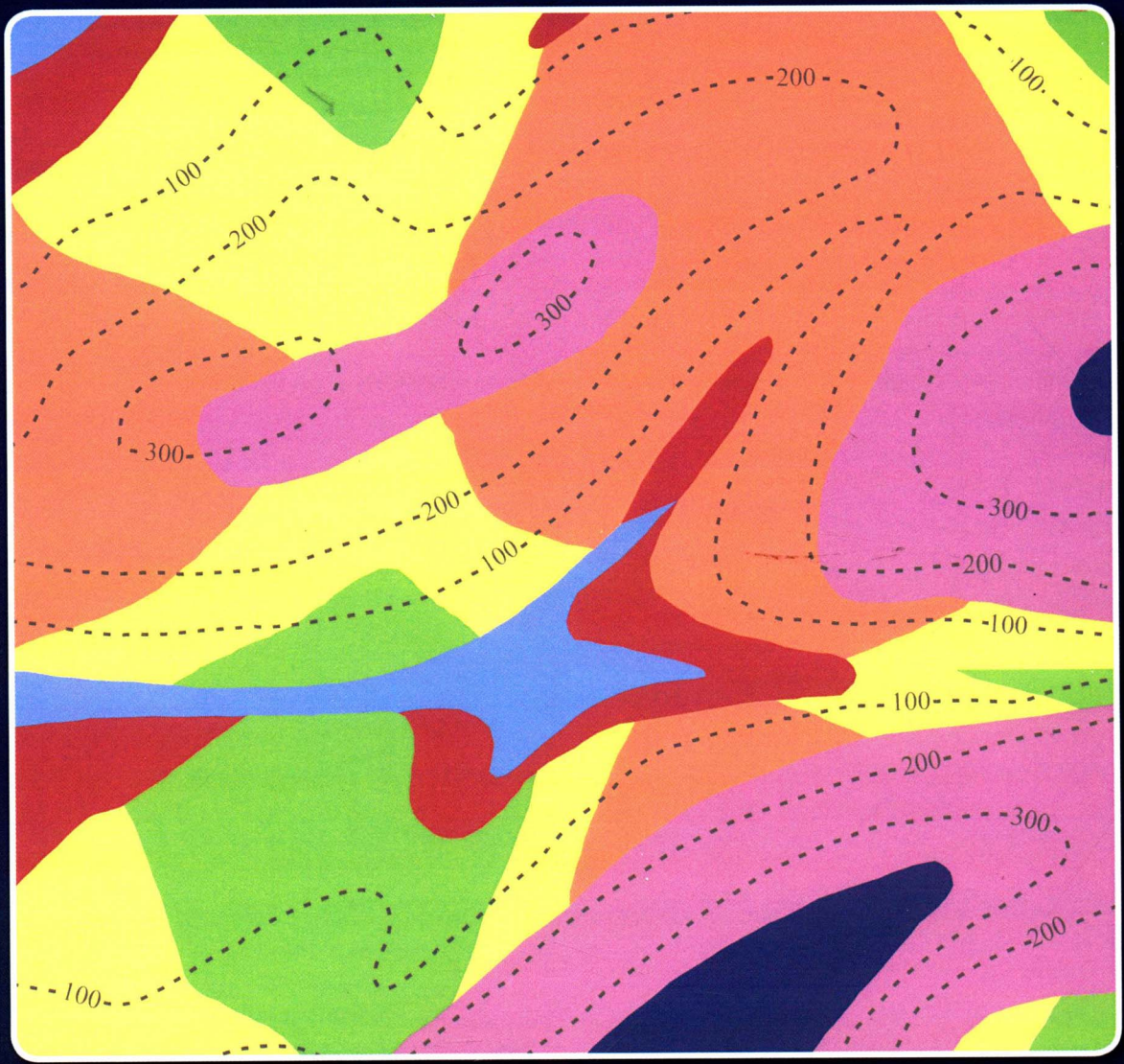
# MAP INTERPRETATION
## *for Structural Geologists*

NARAYAN BOSE & SOUMYAJIT MUKHERJEE

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1

# MAP INTERPRETATION
## *for Structural Geologists*

**NARAYAN BOSE & SOUMYAJIT MUKHERJEE**

The first volume in the new series Developments in Structural Geology and Tectonics, this book is a step-by-step guide presenting common problems and solutions in geological and structural map interpretation

- Features approximately 30 full-color geological or structural maps and their solutions, from basic to the most complex
- Includes content appropriate for undergraduate and graduate students and professional geoscientists alike
- Presents a self-learning guide and teaching manual with minimum instruction required

***Map Interpretation for Structural Geologists*** exemplifies various topics, from deciphering topography using contour patterns to interpreting folds, faults, unconformities, and dykes. By solving several types of maps, this book gives readers the confidence to solve difficult geologic questions related to map interpretation in the classroom and in the field. Interpreting geological and structural maps is an inseparable part of learning structural geology in the undergraduate curriculum and postgraduate development.

**Narayan Bose** is a final year PhD student at the Indian Institute of Technology Bombay, where he did his MSc in Applied Geology (2013). He received BSc (Honors) in Geology from the Presidency College (Kolkata) in 2011 and secured second rank in this program under the University of Calcutta. He is specialized in structural geological fieldworks and microstructural studies especially related to ductile and brittle shear zones. As a Teaching Assistant, he has been conducting structural geology fieldworks and practical classes for the Master's programs in Applied Geology, Applied Geophysics, and Petroleum Geoscience. He has also reviewed several manuscripts submitted in international journals, and has published a paper in the International Journal of Earth Sciences.

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Developments in Structural Geology and Tectonics

# MAP INTERPRETATION FOR STRUCTURAL GEOLOGISTS

## Volume 1

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Cover image: Reproduced from a part of map 7 of Platt (1951). The entire map has been solved as Map 6.8 in this book.

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# MAP INTERPRETATION FOR STRUCTURAL GEOLOGISTS

## About the Series

"Developments in Structural Geology and Tectonics" is an Elsevier book series where potential authors are welcome to contact the Series Editor: Soumyajit Mukherjee (soumyajitm@gmail.com, smukherjee@iitb.ac.in) with new book proposals either as authors or editors. All theoretical, practical, regional and interdisciplinary topics of structural geology and tectonics are welcome as potential book proposals.

# Dedication

S. Mukherjee dedicates this book in loving memory of his grandmother late Namita Mukherjee.

# Preface

Interpreting topography and structures from geological maps is a fundamental and compulsory exercise for Bachelors and Masters students in geosciences. This book presents how to interpret maps and draw their cross-sections. Students are requested to consult standard textbooks of structural geology for definitions and diagrams for the common terms used in this book. A number of solved maps are provided along with few unsolved exercises for practice. This will help students to practice map interpretation with nominal guidance. Starting from preliminary concepts (e.g., topography, horizontal, and inclined beds), maps with single "components" (folds, faults, and unconformities) are explained. This is followed by maps with multiple components and map completion exercises. We believe the book provides sufficient information for a single semester to teach beginners. We welcome any comments, suggestions, or alternate explanations for the solved maps at: narayan.bghs@gmail.com and soumyajitm@gmail.com.

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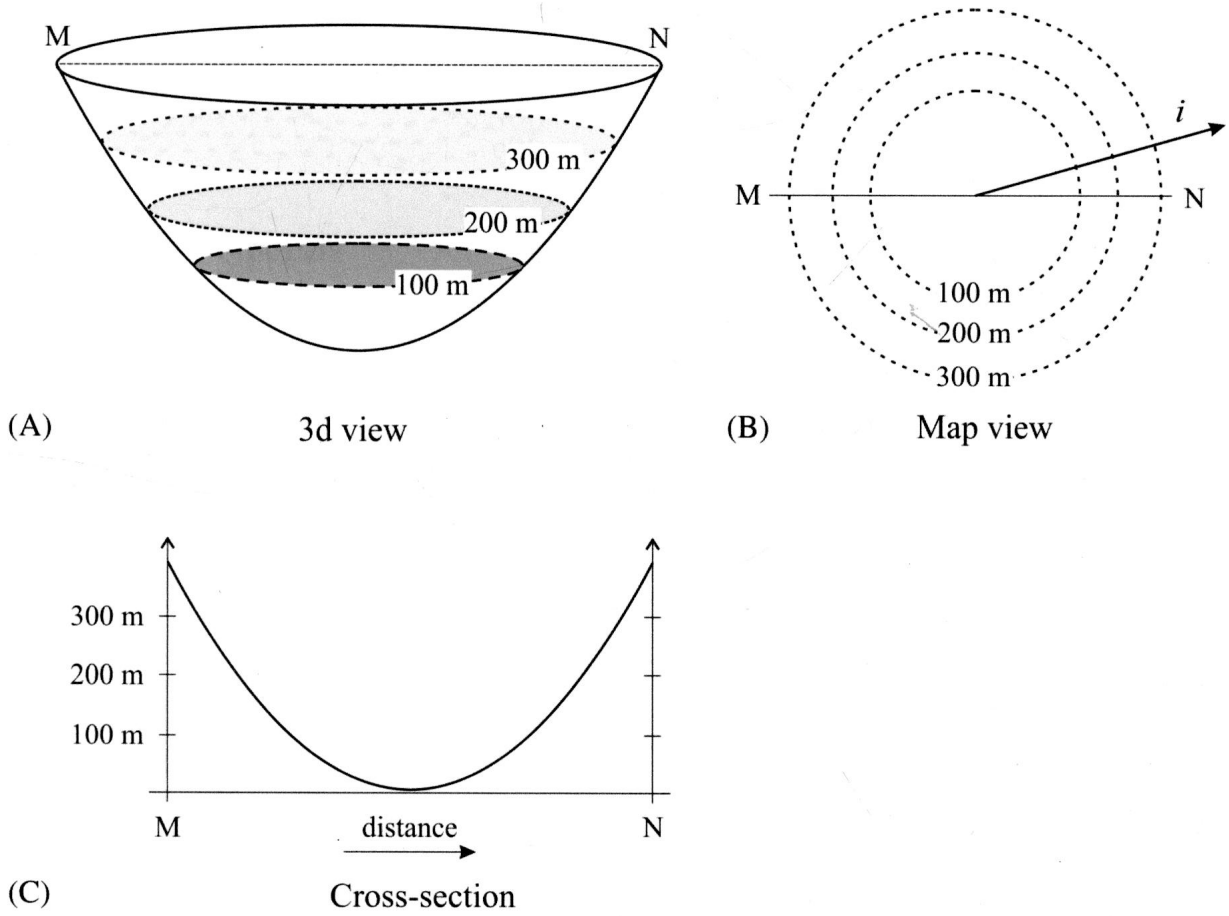
CHAPTER

# 1

# Topography

In geological maps, the undulation of the topography is represented by height contours. These contours represent lines along which all the points have the same altitude. Height contours are represented usually by broken lines and the numbers attached to them indicate the altitude of the corresponding contour. A vertical cross-section (herein referred to as "cross-section") accompanies a geological map, in almost all cases. Cross-sections represent various topographic and sub-surface structural geological features. Concept 1.1A exemplifies of how a three-dimensional topographic feature is presented in a map (as height contours) and in a cross-section. Concepts 1.1B and 1.1C show how various topographic features can be understood from height contours.

Map 1.1 has only height contours. The task is to describe different topographic features present in Map 1.1, as well as to draw a suitable cross-section.




CONCEPT 1.1A Representation of a basin in various ways. Schematic diagrams. (A) Three-dimensional view. Height horizons are marked. (B) Note how the height contours look similar to those in map view. The height increases as one moves away from the centre (as indicated by the arrow "*i*"). (C) Vertical section along MN marked in (A).

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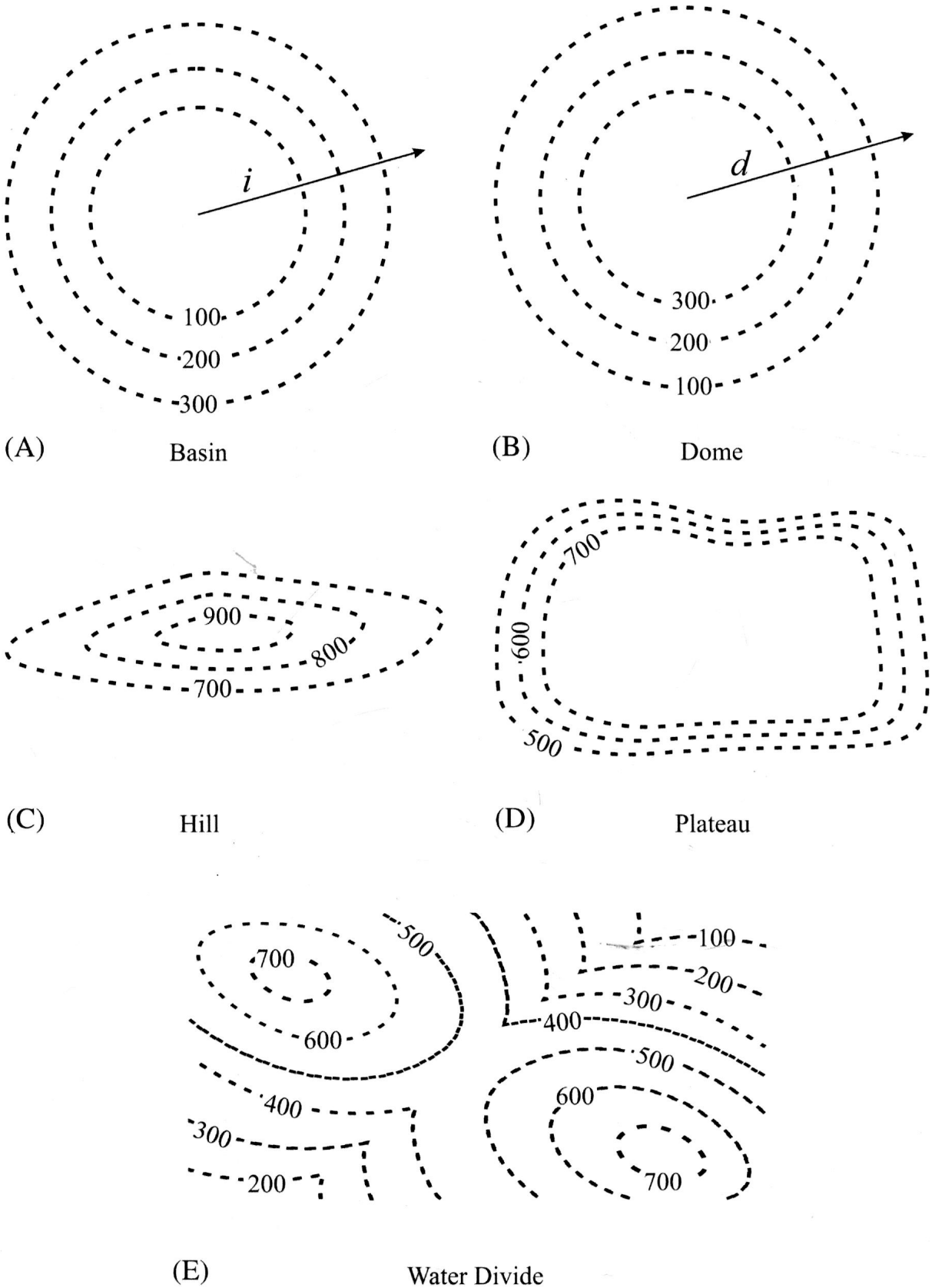


CONCEPT 1.1B Contours of topographic features: (A) Basin, where height increases ("*i*") away from the centre. (B) Dome, where altitude decreases ("*d*") away from the centre. (C) Hill. Here the slope of the topography along E–W is much gentler than that along N–S (note spacing between adjacent contours). (D) Plateau. Here an elevated flat surface is bound by "steep" slopes. (E) Water divide. Here elevated portions together function as a water divide, since two oppositely draining valleys generate from this part. One drains towards NE and the other towards SW.



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