

Applied Geological Micropalaeontology



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***Dedicated to
my revered teacher
Professor S. N. Bhalla***

Preface

Microfossils have wide applications in the field of Geology, Zoology, Botany, and Oceanography. After contributing a book entitled 'Microfossils and their applications' in 1998, I felt that the gap between the researches in the field of Micropaleontology and the existing text-books is widening tremendously.

In the last 25 years Micropaleontology has emerged as an advanced branch of earth sciences progressing at a rather fast-pace than expected, owing to its interpretative taxonomy that helped us solving enduring problems in the fields of Geology and Oceanography especially the higher resolution biostratigraphy, paleoenvironment, basin evolution for petroleum exploration, climatology etc.

The present book entitled 'Applied Geological Micropaleontology' incorporates the text on the various microfossil groups. It is endeavoured to incorporate the existing knowledge in a systematic, comprehensive and expressive manner enabling the readers including those with mathematical background to choose Micropaleontology as their careers.

The book consists of 7 chapters, plates, appendix, bibliography, general index and systematic index. Chapter 1 is intended to provide the background and fundamental information required to delve into the subject through further chapters; Chapter 2 deals with the various techniques employed in the collection of samples, separation of microfossils, illustrations, micrography, intraspecific variation and migration studies, statistical and computational studies; Chapter 3 is devoted to the various aspects of foraminifera, their classifications, ecology, applications, geological distribution etc.; Chapter 4 is devoted to Diatoms, their classifications, ecology, applications; Chapter 5 covers aspects on the Calcareous Nannoplanktons, their classifications, ecology, applications, geological distribution etc.; Chapter 6 is devoted to Ostracoda, their morphology, taxonomy, ecology, geological applications and geological distribution; and Chapter 7 the various aspects of Conodonts, techniques of their studies, biology, composition and ecology. Besides, each most of the chapters are supplemented with illustrative Glossary at the end.

To summarise this book provides a logically arranged text on microfossils that forms part of the syllabus at postgraduate level in the institution offering Geology, Applied Geology and Petroleum Geology.

I would welcome suggestions from readers on the shortcomings left in the text.

21st July 2011

Sagar

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CHAPTER 1

Introduction to Microfossils

Contents

- 1.1 Introduction
- 1.2 History of development of Micropalaeontology
- 1.3 Classification of living organisms
- 1.4 Stratigraphic Micropalaeontology

Glossary of selected terms

1.1 INTRODUCTION

Palaeontology, coined by de Blanville and Von Wolderheim (1834) is a discourse on study of fossils (fossil, Latin *fodere*, dug-up), the remains of organisms that by certain process, have become a part of rocks, they are found embedded in and may be considered as 'evidences of life' of pre-historic times. It has gradually replaced the term 'orycotology'.

Palaeontology (Paleontology) has evolved through Zoology, which is a discourse on the living animals and may be subdivided into: (a) Neontology, related to the 'existing' life and (b) Palaeontology or Paleobiology, to the 'ancient' or extinct life (Fig. 1).

Palaeontology has gained the status of an essential tool for stratigraphers working on various aspects viz. stratigraphic correlation, strata-identification, high-resolution stratigraphy, event stratigraphy, basin-evolution, establishment of sequences and determination of paleoenvironment, paleoecology and paleogeography. From biological points of view it yields important evidences for the study of evolution and adoption of organisms to different environments.

Microfossils require special methods of collection, separation, illustration and identification and can only be studied under microscope. Therefore, Micropalaeontology was introduced as a separate branch of Geology in 1863 by Ford to study fossils of small invertebrates (< 0.1 mm, diameter/length) e.g., foraminifera, diatom, radiolaria, ostracoda, nannoplankton, brayozoa etc. or parts of macro-invertebrates whose study require use of a microscope throughout. It incorporates study of organisms of the geological past, their structures and genetic relationships in time and space.

Microfossils have a vast application in various geological areas especially in the biostratigraphy and petroleum exploration owing to their great abundance in time and space, wide morphological variability, and usefulness in paleoenvironmental interpretations. In the Indian context, their application in the study of paleomonsoonal precipitation has gained momentum in the last three decades. The types of microfossil groups, their composition and applications have been enumerated in Table 1.1.

The Scanning Electron Microscopy (SEM), however, revolutionised taxonomy and applications of microfossils in multifaceted ways.

1.2 HISTORY OF DEVELOPMENT OF MICROPALAEONTOLOGY

The modern history of Micropalaeontology is no older than seven decades. However, the first mention of fossil in the literature dates back to the Greek natural philosopher Herodotus in the 5th century when he noticed coin shaped Foraminifera (*Nummulites*) embedded in limestone blocks used in the Egyptian pyramids and described them as 'stone lentis' or 'coin fossil'. In middle of the 16th century Agricola and Gesner and in the early 17th century Scheuchzer recognised them as 'stone fossils'. The advent of microscope in 1660 by Leeuwenhoek accelerated the pace of study of microfossils of Tertiary sediments. Beccarius (1731) gave systematic description of micro-foraminifera. In the middle of the 17th Century, Plancis published a monograph on Recent foraminifera of sediments.