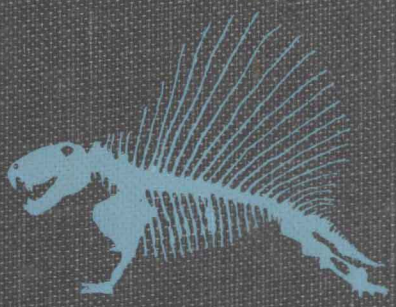

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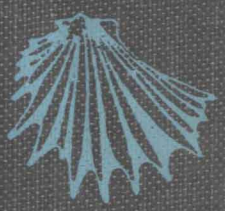
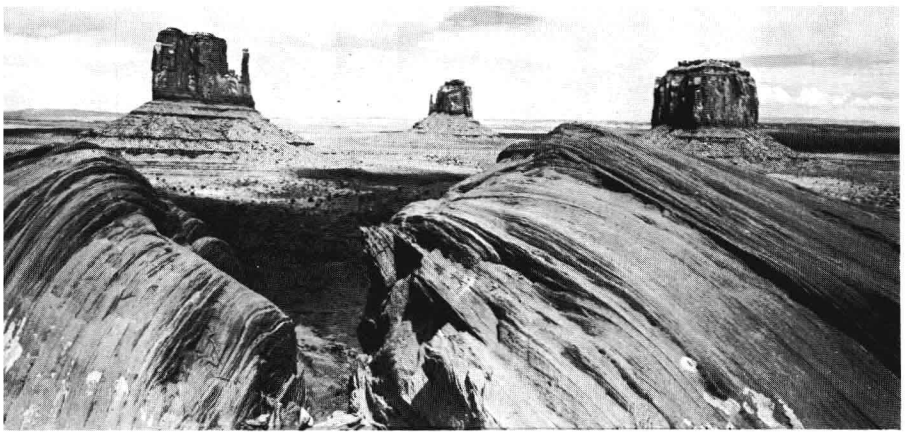


Basic Concepts of Historical Geology

EDGAR WINSTON SPENCER
Chairman, Department of Geology
Washington and Lee University



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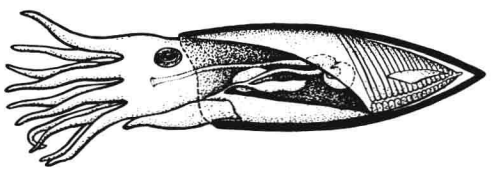

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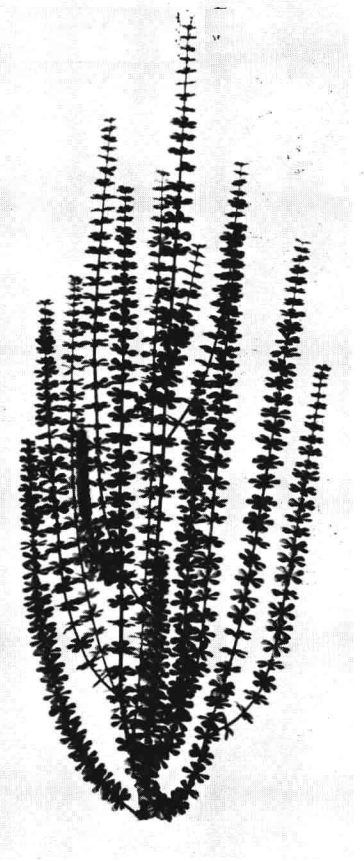

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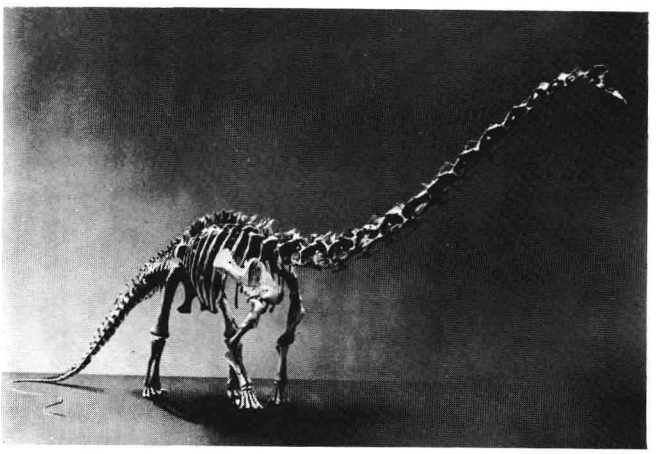

To my father TERREL FORD SPENCER *in sincere gratitude*

Preface

Basic Concepts of Physical Geology and *Basic Concepts of Historical Geology* were written as a single integrated book for a one year course in Physical and Historical Geology. The text is designed for students who are taking geology as a liberal arts subject as well as for students who plan to major in geology. It has been published in two volumes, each presenting the material traditionally covered in one semester courses in Physical and Historical Geology. The two volumes complement one another, but they may be used separately without difficulty. Because the concepts of geologic time and the place of the earth in the universe are so important, a brief treatment of these topics has been included in the volume on Physical Geology for those students who will not take a full year course. A more comprehensive treatment is given in the volume on Historical Geology.

This text has been written in the full recognition that there are a number of fine textbooks available which cover the principles and processes of geology. However, this book is written from a different point of view and with a somewhat different purpose in mind. It is assumed that the student comes to this first course in geology without a background in natural science, but with a curiosity about the earth on which he lives, an open mind, and a willingness to learn. It is hoped that he will carry away from the course a grasp of the fundamental ideas of geology, a knowledge of the scientific methods used by geologists, their limitations, and an awareness of the broad scope of the field and its major contributions to human knowledge. The material selected, its organization, and the manner of presentation are designed to accomplish these purposes rather than to stress terminology, processes, or detailed factual data. However, it is recognized that many of the basic and most important ideas cannot be grasped without a working knowledge of certain scientific terms and processes. These are defined as they are introduced.

Treatment has been highly selective. Some topics are developed fully in order to give the student an appreciation for the thoroughness characteristic of scientific investigations. Other

advanced, even controversial, ideas are discussed briefly to give the student a glimpse of the research problems faced in the earth sciences, and the scientist's need for imagination as well as factual information in seeking the solutions. The interdependence of the natural sciences is emphasized throughout.

Outlines are employed where they will be most useful to the student as a means of quick summary. Data which are often presented in appendices are incorporated in the chapters to which they are most pertinent. Each volume has a set of eight pages of color maps at the end of the book. These are intended to illustrate various types of geologic and topographic maps, and to provide the teacher with a valuable tool for map study.

Both volumes have a number of new features. The Physical Geology text presents:

1. An introductory section about the profession of geology, what geologists do, how the field is applied, the means of communication, and the methods used by geologists.
2. A chapter on the sources of energy for processes acting in and on the earth.
3. A chapter dealing with the major divisions of the crust of the earth.
4. A chapter on the concept of sequential development of land forms by various geomorphic agents. The limitations of this idea are also clearly explained.

The text on Historical Geology presents:

1. An expanded discussion of the methods used to unravel the history of the earth.
2. Discussions of the origin of the atmosphere and hydrosphere.
3. A chapter on the origin of life on earth.
4. A short chapter dealing with the controversy over the nature of the continental borders of North America during the Paleozoic. Both the borderland hypothesis and the island arc hypothesis are explained.
5. A chapter devoted to the description of the most important groups of invertebrates is presented before the history of North America. Thus the student is supplied with information about the morphology and ecology of each group before he is confronted with data about the time of its first appearance or its evolution.
6. The physical history of North America is taken up starting with the Precambrian and continuing to the present. These chapters are brief; each contains a summary of the life of the period, a summary of the physical history of the United States for the period, and a discussion of several of the most important aspects of the physical history. These are selected to illustrate particular concepts or methods.
7. The theory of evolution of life is treated separately from the physical history of the continent.
8. A chapter explaining the main trends of the evolutionary processes with examples from the invertebrates precedes the story of the development of fishes, amphibians, reptiles, and mammals.

This text is designed and written for the elementary college level student.

EDGAR WINSTON SPENCER

Washington and Lee University
Lexington, Virginia

Acknowledgments

It should be recognized by all who read this text that our knowledge of the world is based on the work of many individuals. The findings of some of these individuals are so often used and widely recognized that they become a part of our general knowledge. After a time the source may be forgotten. The efforts of others may never become widely recognized even though they provide the basis for important discoveries of later workers. Scientific methods lead to a pyramiding of knowledge. We owe a debt of gratitude to all who have contributed. In a text the findings of only a few individuals can be selected for discussion. Direct acknowledgment to these persons has been made in the text where it seems most appropriate. Likewise, acknowledgments for illustrations and photographs have been made in the headings for these.

I am especially indebted to the late Professor Marcellus Stow of Washington and Lee University whose teachings and personal friendship led me into the field of geology. To my teachers at Columbia University, Professors Arie Poldervaart, Walter Bucher, Maurice Ewing, Marshall Kay, Charles Behre, Sidney Paige, John Imbrie, and Arthur Strahler, I am most grateful for the inspiration of their teaching and their dedication to the study of the earth. The research and teachings of these men have greatly influenced my thinking and approach to earth science; however, I alone am responsible for any errors which may appear in this book.

My sincere thanks go to those friends, colleagues, and students who have given me the benefit of their ideas about teaching elementary geology, and to those who have helped directly in the preparation of the manuscript and illustrations in this book. For his patience and thoroughness throughout the work in editing this text I wish to thank my friend, Philip Winsor.

I appreciate the many helpful suggestions of Miss Agnes Creagh who assisted in editing the manuscript.

I am most grateful to my wife not only for her encouragement, but for drawing many of the illustrations and for reading and making suggestions about the preparation of the manuscript.

E. W. S.

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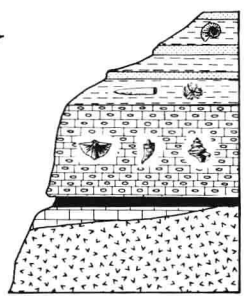

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