

**BASIC BOOKS IN SCIENCE** – a Series of books that  
start *at the beginning*

## **Book 6**

# **The planet we live on - the beginnings of the Earth Sciences**

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(Last updated 10 May 2007)

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### Acknowledgements

In a world increasingly driven by information technology and market forces, no educational experiment can expect to make a significant impact without the availability of effective bridges to the ‘user community’ – the students and their teachers.

In the case of “Basic Books in Science” (for brevity, “the Series”), these bridges have been provided as a result of the enthusiasm and good will of Dr. David Peat (The Pari Center for New Learning), who first offered to host the Series on his website, and of Dr. Jan Visser (The Learning Development Institute), who set up a parallel channel for further development of the project with the use of Distance Learning techniques. The credit for setting up and maintaining the bridgeheads, and for promoting the project in general, must go entirely to them.

Education is a global enterprise with no boundaries and, as such, is sure to meet linguistic difficulties: these will be ameliorated by the provision of translations into some of the world’s more widely used languages. We are most grateful to Dr. Angel S. Sanz (Madrid), who has already prepared Spanish versions of the first few books in the Series: these are being posted on the websites indicated as soon as they are ready. This represents a massive step forward: we are now seeking other translators, at first for French and Arabic editions.

The importance of having feedback from user groups, especially those in the Developing World, should not be underestimated. We are grateful for the interest shown by universities in Sub-Saharan Africa (e.g. University of the Western Cape and Kenyatta University), where trainee teachers are making use of the Series; and to the Illinois Mathematics and Science Academy (IMSA) where material from the Series is being used in teaching groups of refugee children from many parts of the world.

All who have contributed to the Series in any way are warmly thanked: they have given freely of their time and energy ‘for the love of Science’. Paperback copies of the books in the Series will soon be available, but this will not jeopardize their free downloading from the Web.

Pisa 10 May 2007

Roy McWeeny (Series Editor)

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variable. The sources of all the images are acknowledged in the final pages - many thanks to all those who made them available, particularly Stephen Davies from Geopix and Peter Kennett from the Earth Science Education Unit. I am also hugely indebted to Henry Law for technical and editorial support and for managing the layout of the text, and to my wife Phoebe and my family, for putting up with me during the writing.

Manchester 19 December 2009

Chris King (Author)

## BASIC BOOKS IN SCIENCE

– a Series of books that start *at the beginning*

### About this Series

All human progress depends on **education**: to get it we need books and schools. Science Education is especially important.

Unfortunately, books and schools are not always easy to find. But nowadays all the world's knowledge should be freely available to everyone – through the Internet that connects all the world's computers.

The aim of the Series is to bring basic knowledge in all areas of science within the reach of everyone. Every Book will cover in some depth a clearly defined area, starting from the very beginning and leading up to university level, and will be available on the Internet *at no cost to the reader*. To obtain a copy it should be enough to make a single visit to any library or public office with a personal computer and a telephone line. Each book will serve as one of the 'building blocks' out of which Science is built; and together they will form a 'give-away' science library.

### About this book

This book, like the others in the Series, is written in simple English – the language most widely used in science and technology. It provides an introduction to the study of 'Earth science', but 'Earth science' is interpreted differently in different countries. In some regions of the Earth, such as on the Pacific margins, it usually covers all the science relating to the Earth, including geology, meteorology, oceanography, geomorphology and soil science. It therefore covers much of physical geography in these regions, where geography is often not a strong school subject. In other countries 'Earth science' has a rather narrower definition, largely covering only geology, whilst other aspects of 'Earth science' are covered in geography. Nevertheless, wherever on Earth this book is being read, if you want to study 'Earth science' in Higher Education, at College or University, you will study mainly geology. So this book has been written as an introductory guide to geology, to interest you in the subject and to enthuse you to study geology at higher levels.

The study of geology takes many forms, but the way that most geologists begin their work is to interrogate the Earth for clues about Earth processes, in the past, present and future. This is the approach of the 'rock detective', looking for clues that will answer scientific questions about the Earth. Answering some questions always poses other questions, and so the study of geology continues ....

**Notes to the Reader.** When Chapters have several Sections they are numbered so that "Section 2.3" will mean "Chapter 2, Section 3". Important 'key' words are printed in **boldface**: they are collected in the Glossary at the end of the book.

**Looking ahead** — If you came across a cliff face on a mountain, in a coastal area or in a cutting or old quarry, and it was made of interesting-looking rocks - how could you find out more? The first Chapter of this book will help you to learn to ‘read’ a rock face, by finding out about the minerals that make up the rocks and how they are formed. Then you will be introduced to how the rocks themselves were formed, in sedimentary, igneous and metamorphic ways. When you know how rocks formed, you can understand how they were often later deformed, usually deep within the Earth. As these things happen to the rocks, they retain clues of the order of the events, allowing us to work out the sequence of processes and thus the geological histories of whole areas, as well as what might happen next.

The landscape also contains clues to how it formed, so by standing on a hill with a good view, you will see evidence of the underlying rock structure and how this has controlled the shape of the land. You can see clues to the processes that are still active there and the ways that the land is being used by humans. This approach, covered by Chapter 2, is another way of interpreting the evidence of your own observations to find out ‘how the Earth works’ now and in the past. In doing these you will be applying some of the ‘big ideas’ of geology, outlined in Chapter 3. Ideas about the rock cycle developed from the 1700s onwards but it wasn’t until the 1960s that the theory of plate tectonics was understood, explaining many aspects of the Earth that scientists hadn’t been able explain before then. In the 21st century, ‘climate change’ and the supply of raw materials are the most important areas of geoscientific study, helping us to understand how we will need to live on Earth in the future. Important threads that hold studies of these issues together are an understanding of geological time related to the evolution of life, and how the Earth changed in the past through plate tectonic movement, as in Chapter 4.

The basic understanding developed through Chapters 1 to 4 allows you to respond to the Chapter 5 coverage of media reports about geoscience events. The media often report events that might affect you directly, such as Earth hazards and local quarrying and landfill sites, as well as longer term issues on which you might have an impact, such as in ‘climate change’. The media often report spectacular fossil finds as well, also covered by Chapter 5. This builds up to Chapter 6, covering what geologists actually ‘do’ today. Here you can get a feel for what an oil geologist and a mineral prospector does and how we look for underground water. Find out about the vital work that geologists do in construction and in conserving the environment and finally visit the applied and ‘blue skies’ studies carried out by research geologists. Through this final Chapter, you will gain a taste of what a working geologist does from day to day - and this might encourage you to carry your geological studies further.

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