

BOOK REVIEWS

Earthquakes and Animals: From Folk Legends to Science by Motoji Ikeya. Singapore: World Scientific, 2004. xix + 295 pp. \$78.00 (cloth). ISBN 981-238-591-6.

Since there has been much death and destruction resulting from earthquakes, earthquake prediction has been a hot topic of interest to the mass media and to the general public, as well as to scientists. Despite the fact that there are great debates on earthquake prediction among scientists, most scientists continue to monitor only earthquake precursors such as seismicity patterns, crustal deformations, electromagnetic signals, changes in underground water and so on. Almost absent are professional studies on the so-called macro-phenomena before earthquakes (e.g., unusual behavior of animals, plants and inanimate objects). *Earthquakes and Animals*, by Motoji Ikeya, provides a serious work looking for a scientific basis for folk legends about macro-phenomena before earthquakes.

Following an outline in the preface, the book is divided into six parts. Part I includes two chapters (Chapters 1 and 2). Chapter 1 describes legends of some earthquake precursors, especially unusual atmospheric phenomena and unusual behavior of animals, plants and inanimate objects. Chapter 2 gives retrospective reports of the aforementioned unusual phenomena or behavior before some recent large earthquakes in Kobe, Japan (M 7.2, 1995), Izmit, Turkey (M 7.4, 1999), Taiwan (M 7.7, 1999) and India (M 7.7, 2001). Some results of studies on the unusual phenomena and related comments are given in the same chapter.

Part II (Chapter 3) introduces elementary knowledge of earthquakes and electromagnetism. This section may provide the basic physics for the general public to understand the following chapters in the book. However, it may be difficult for the general public to understand all of the basic physics described in this chapter.

Part III (Chapters 4–6) discusses unusual behavior of animals and plants. Chapter 4 describes the experiments of electric field effects on various animals, showing behavioral responses of animals to electromagnetic pulses and the possibility of evaluating preseismic electric field intensity around the focal area by extrapolating from these experimental results and the reports of unusual animal behavior before earthquakes. Chapter 5 introduces a rock compression experiment and animal responses to electromagnetic waves produced by rock fracture. Chapter 6 discusses unusual behavior of plants before earthquakes and experiments on plant responses to electromagnetic exposure.

Part IV (Chapters 7–9) deals with unusual behavior of inanimate objects before earthquakes. Chapter 7 introduces unusual atmospheric phenomena such as earthquake lightning, clouds, fog, rainbows and unusual formations in the sky. Chapters 8 and 9 discuss other unusual earthquake-related phenomena such

as ground sound, air bubble movement, bent candle flames, phenomena in the aquasphere, behavior of electric appliances and so on. Some electromagnetic explanations or alternative explanations have been offered for these phenomena.

Part V (Chapter 10) develops an automatic system of monitoring animal behavior and discusses an experimental forecasting model.

Part VI comprises chapters 11 and 12. Chapter 11 gives a general survey of the study of seismo-electromagnetic signals, including both ground and satellite observations. Chapter 12 provides a summary and discusses topics for future research.

This book is a valuable attempt to seek a scientific basis for the folk legends about macro-phenomena before earthquakes. The mass media and the general public have paid much more attention to the macro-phenomena than to the precursors recorded by professional scientists. The general public wishes to know whether the legends and reports of these unusual phenomena have some scientific basis or are merely superstitions. Scientific work concerning the macro-phenomena is rare. The few studies include a book by Chinese biophysicists (Earthquake Research Group of Institute of Biophysics, Chinese Academy of Sciences, 1977) and a conference proceeding of the U.S. Geological Survey (USGS; Evernden, 1976), summarizing and explaining reports of unusual animal behavior before earthquakes. Although *Earthquakes and Animals* is not the first scientific book to explain animal behavior before earthquakes, it is the first one to summarize various macro-phenomena and to develop an electromagnetic model as a scientific explanation of these phenomena. Besides the general description and the model explanation, this book gives many interesting examples of reproducing the reported unusual phenomena in the laboratory. This may be helpful for the general public to understand the scientific basis for folk legends and may become educational material used in high schools.

One main reason that scientists disregard the macro-phenomena before earthquakes is the difficulty in quantifying them. I am pleased to see that the author has developed an automatic system of monitoring catfish behavior. Such monitoring may provide more objective observation of the precursory phenomena, compared with reports from lay citizens. This book also describes an experimental forecasting model using animal monitoring. Although this is an interesting experimental test, there is almost no significant advantage, at least in the sense of science, compared with other precursors nominated by the International Association of Seismology and Physics of the Earth's Interior (IASPEI).

It seems that the author complained too much in this book about the prejudice from some scientists against his serious work. In fact, even the candidates that are officially nominated by the IASPEI as significant precursors of earthquakes are not well accepted by the whole of academic society—to say nothing of the nonnominated macro-phenomena, which are generally not as well quantified as the nominated candidates are.

This is an interesting book, not only for the mass media and the general public, but also for the scientists who wish to be involved in interdisciplinary

study. Chapter 5 shows an example of cooperating with a biologist in analyzing blood plasma and brain hypothalamus fluid in rats before and after a rock compression experiment. This is a good start for interdisciplinary study. The bibliography and reading list at the end of the book include many references, not only to macro-phenomena, but also to earthquake-related electromagnetic studies and will be quite useful to readers. The index is helpful for rapid searches.

Although some explanations in this book may not be the most satisfactory ones for the macro-phenomena before earthquakes, I was impressed with the efforts of the author. I expect that this book will be helpful for disaster prevention for lay citizens, who find it impossible to monitor and to analyze the officially nominated precursors. I also expect that this book will encourage more scientists to join this kind of interdisciplinary work.

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References

- Earthquake Research Group of Institute of Biophysics, Chinese Academy of Sciences (1977). *Animals and Earthquakes* (in Chinese). Beijing: Seismological Press.
- Evernden, J. F., Ed. (1976). *USGS Proceeding of Conference I: Abnormal Animal Behavior Prior to Earthquakes*. U.S. Geological Survey (USGS).

When Life Nearly Died: The Greatest Mass Extinction of All Time by Michael J. Benton. Thames & Hudson, 2003. 336 pp. \$29.95 (cloth), ISBN 050005116X; \$24.95 (paper), ISBN 050028573X.

Gorgon: Paleontology, Obsession, and the Greatest Catastrophe in Earth's History by Peter D. Ward. Viking Penguin, 2004. 257 pp. \$27.95 (cloth), ISBN 0670030945; \$15.00 (paper), ISBN 0143034715.

Mass extinctions have long captivated scientists and the general public alike. The idea that a giant asteroid slammed into Earth 65 million years ago and caused the extinction of the dinosaurs at the end of the Cretaceous sounds like great science fiction, except that most scientists now accept it as true. Paleontologists and geologists also accept that an even more massive catastrophe happened about 251 million years ago, at the end of the Permian period. According to Douglas Erwin (1996), this "mother of all mass extinctions" boasts estimates of global extinction as high as 95%—but it hasn't produced a proportional impact on the public psyche, or even that of the scientific community.

Two things are probably to blame for the underappreciation of the Permo-Triassic (PT) mass extinction: first, the majority of victims (groups with obscure