

Early Earthquakes in the Americas

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Volume 33, numéro 1, march 2006

URI : https://id.erudit.org/iderudit/geocan33_1rv04

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Éditeur(s)

The Geological Association of Canada

ISSN

0315-0941 (imprimé)

1911-4850 (numérique)

[Découvrir la revue](#)

Citer ce compte rendu

Clague, J. J. (2006). Compte rendu de [Early Earthquakes in the Americas]. *Geoscience Canada*, 33(1), 33–34.

have preferred a somewhat more varied use of examples in order to expose the reader to a broader range of applications using different data sets.

Chapter 1 provides a rather brief history of cyclostratigraphy, followed by an introduction to time series analysis. Weedon's synthetic time series (Figures 1.6 and 1.7) are particularly instructive. The author demonstrates the progressive increase in the graphic visual complexity of perfectly ordered, relatively simple time series in which several cycles are present, and their resolution into simple line spectra with time series analysis. The key bullet at the end of the chapter highlights the ability of spectral analysis to detect multiple regular cycles.

In Chapter 2, the author addresses the construction of time series in cyclostratigraphy. The reader progresses through a concise and very useful section in which discrete- and continuous-signal records are clearly and succinctly described. Three conditions fundamental to the construction of meaningful time series follow and should not be disregarded by those who seriously intend to undertake such an exercise. The chapter ends with a brief discussion of sampling, sample intervals, and aliasing related to sampling procedures. The use of irregularly spaced data is briefly discussed, almost at the level of an aside, and does not sufficiently acquaint the novice with viable alternatives that allow this procedure.

Chapter 3 deals with spectral estimation; it presents a variety of methods for doing spectral analysis of time series with examples of outputs. Preliminary discussion highlights time series that require pre-processing. The determination of statistical significance of spectral peaks completes the chapter. Here the author has, as promised in his preface, kept mathematics to a minimum. Chapter 4 continues in a partially similar vein, but here less familiar methods of time series analysis such as phase spectra, complex demodulation, wavelet analysis and singular spectrum analysis are presented. Much of this chapter deals with methods that allow follow-up analysis after a time series has yielded spectral indications of potentially significant periodicities.

In Chapter 5, Weedon deals with practical considerations and offers a cautionary perspective on environmental

cyclicity, its invariable distortion in real stratigraphic records, and limitations on the interpretation of such cyclic signatures. Here synthetic time series, simplified in a mathematical context but still graphically realistic, provide an especially useful illustration of the author's points. This chapter is perhaps the most enlightening for the uninitiated reader. One suspects that Weedon has avoided overt criticism of certain techniques that deal with sediment accumulation rate distortions of natural time series. He cites instances where methods have been shown to give results "other than expected". Such restraint may be appropriate for a general text, but this lack of emphasis does not serve the target audience well.

Weedon finishes strong with Chapter 6 in which he links environmental processes to the cyclostratigraphic record, beginning with an admission that the mechanism through which this is done remains controversial in many instances. Perhaps fewer pages could have been used to address the climate spectrum but this might simply reflect new emphasis in this field in very small scale cyclicity in the stratigraphic record.

With the publication of this introductory book, Weedon has achieved his stated objective of providing a text on methods and concepts in cyclostratigraphy and time series analysis for students and those new to the field. Any disappointment I felt with the text no doubt reflects slightly different personal views, no fault of the author. My only criticism is in Weedon's hesitation to highlight in more detail some of the contentious issues in methodology and in the interpretation of spectral results, an effort that would have served the reader well. For example, Weedon could have usefully addressed very current research where orbital versus radiometric time-scale estimations are dramatically at odds and remain unresolved. The dramatic successes in the development of astronomical time scales receive lots of emphasis, and appropriately so. Why not some of the controversial issues which should be cautionary eye-openers for the neophyte?

Early Earthquakes in the Americas

By Robert L. Kovach

Cambridge University Press, New York, 2004
ISBN 0-421-82489-3

US \$90.00, hardcover, 268 p.

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This book, written by geophysicist Robert Kovach, documents large earthquakes of the last millennium in the Americas and describes their effects. The author's premise is that much can be learned about earthquakes from myths, legends, and accounts and from the effects of past disasters on human settlements.

The book includes 12 chapters. An introduction (Chapter 1) is followed by short summaries of the seismo-tectonic setting of the Americas (Chapter 2), earthquakes in myths and legends (Chapter 3), and earthquake effects (Chapter 4). The next six chapters are a "cook's tour" of earthquakes in different parts of the New World: Mexico (Chapter 5), the Maya empire (Yucatan, Belize, Guatemala, and Honduras; Chapter 6), Costa Rica, Panama, and Colombia (Chapter 7), Peru and Chile (Chapter 8), California (Chapter 9), the North American Cordillera (Chapter 10), and eastern and central America (Chapter 11). A very short concluding chapter is followed by several appendices, a glossary, bibliographic summaries for each chapter, and a list of references.

Cambridge University Press states that "students and researchers in the fields of earth science, archaeology, and history will greatly benefit from this book. I'm not so sure about this assertion, as I had difficulty, as reviewer, identifying the audience for the book. Geologists would like to know what the geological record can tell them about earthquakes in space and time, but this book probably will not interest them. Seismologists may benefit from the useful tables of historical earthquakes included in the book, but there are no new insights into seismicity in the Americas. Archaeologists need to under-

stand that damage at settlement sites in Central and South America may be the result of earthquakes rather than post-abandonment decay, but the discussion of archaeological sites and earthquake evidence in Chapters 5, 6, 7, and 8 is uneven and somewhat cursory. Some students would find the material interesting, but it is unlikely that the book will be used in many university courses because it is such a niche product.

Professor Kovach argues that earthquakes played a role in the evolution of early cultures in quake-prone regions in the Americas. Few would dispute this statement, because, as the author shows, the myths and legends of early people include animistic references to earthquakes. Further, it is not surprising that ancient Zapotecan, Mayan, Incan, and other ruins show evidence of earthquake damage, as the areas in which these people lived are seismically active. In my view, a more interesting question is “How did early people in the Americas adapt to the strong earthquakes they must have experienced?” These peoples were very familiar with earthquakes and they must have adjusted their lives to limit the damage that quakes caused. Scientists have argued that large earthquakes and volcanic eruptions ended ancient civilizations. I find such arguments unconvincing as they assume that early peoples were unable to adapt to natural disasters. As Professor Kovach points out, ancient civilizations can fall due to many causes, including climate change, epidemics, foreign and civil wars, cultural and social decay, and agricultural and economic collapse. Earthquakes, at most, are the *coup de grace* of a civilization in terminal decline.

Professor Kovach argues that archaeology can play an important role in extending the historical record of seismicity. I agree, but the book does not demonstrate that this has been, or can be, done in the Americas. The New World record falls far short of that in the Middle East, especially Israel and Jordan, where surface rupture and other earthquake effects can be related to precisely dated events dating back more than 2000 years. Fault offsets and other damage to archaeological sites in the Jordan River valley, for example, has been used to determine the magnitude of biblically important quakes.

The organization and presentation suffer from the book’s lack of clearly defined audience and purpose.

Chapter 2, on seismo-tectonics of the Americas, is only 11 pages and too general to be useful. Furthermore, some of its content is repeated in the regional earthquake chapters. The regional chapters (5-11) seem somewhat forced, with arbitrary geographic boundaries. Why, for example, separate earthquakes in California from those in the North American Cordillera, especially as the chapter on North American Cordillera includes a section on earthquakes in Death Valley, California? California, of course, is part of the North American Cordillera.

Archaeological sites in quake-prone regions are reviewed in several chapters, but the actual evidence for earthquake damage is not discussed in the detail that I would have liked. Earthquake myths, legends, and damage to famous archaeological sites are included in the chapters dealing with Mexico, the Mayan empire, and Peru and Chile, but are scarcely mentioned in the other regional chapters.

The illustrative material, as a whole, will do little to sell the book. Seventy five of the 135 figures in the book are simple black-and-white maps showing earthquake epicentres, faults, and localities mentioned in the text. Some of the maps could have been combined or better annotated. Thirty six of the remaining figures are photographs; some are very good but others show little and could have been deleted.

Here, then, are my summary and recommendation:

Strong points:

- Earthquake tables
- Description of effects of earthquakes on archaeological sites
- Discussion of relation between earthquake intensity and magnitude
- Reference list

Weak points:

- Lack of clear focus
- Structure
- Figures
- Cost (US\$90 is a hefty price for a 268-page book)

Recommendation. Unless you are a real earthquake junkie, I would pass on this book.

Understanding Environmental Pollution, A Primer (2nd Edition)

By Marquita K. Hill

Cambridge University Press, 2004,

ISBN 0-52182-024-3

\$110.00, hardcover, 484 p.

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Understanding Environmental Pollution is rich in general information about most forms of pollution at the household, local, and global level. It is written for the non-scientist and non-science student, but is also good reading for those who want generic environmental information beyond their level of expertise. The book’s 18 chapters discuss methodically, pollution concepts; major pollutants in air, water and soil; pollution sources; climate change; toxicity and risk assessment, and concepts and efforts to reduce pollution. The concept of pollution is not presented in isolation but rather as a consequence of the integrated actions of society. It is, in this sense, that energy generation and use and its relationship to pollution are presented.

The presentation of material is clear and lively but perhaps, also controversial. Typically, each chapter begins with an appropriate quotation about the right direction forward. This sets the tone for the accuracy about the present situation, which is explained by first presenting the basic concepts about a pollutant e.g., acid deposition, and then by recounting the history of the research and critical debate that have led to our current understanding of the problem – including the skeptics point of view.

The review of each topic spices the reading by adding the human element to what can otherwise be dry material. Also, it goes a long way to explaining the culture of science to the uninformed. For example, in the section on ozone depletion, Hill says, “However, as happens with many environmental issues, there are skeptics. And often, as with ozone, researchers respond to skeptics by doing more research.”

Another effective feature of the book is its inset boxes. These appear as