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978-0-521-83795-8 - Earthquakes and Tsunamis in the Past: A Guide to Techniques in Historical Seismology

Emanuela Guidoboni and John E. Ebel

Frontmatter

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Earthquakes and Tsunamis in the Past

A Guide to Techniques in Historical Seismology

This handbook defines the discipline of historical seismology by comprehensively detailing the latest research methodologies for studying historical earthquakes and tsunamis. It describes the many historical sources that contain references to seismic phenomena, discusses the critical problems of interpreting such sources, and presents a summary of the various theories proposed (from ancient Greek to modern times) to explain the causes of earthquakes – indispensable factors for understanding historical earthquake descriptions.

The text presents numerous examples of interpretations and misinterpretations of historical earthquakes and tsunamis in order to illustrate the key techniques, with a chapter devoted to an explanation of the date and time systems used throughout history in Mediterranean Europe and the Near-East. The authors also tie historical seismology research to archaeological investigations and demonstrate how new scientific databases and catalogues can be compiled from information derived from the methodologies described.

This is an important new reference for scientists, engineers, historians and archaeologists on the methodologies for analysing earthquakes and tsunamis of the past. Illustrated with examples from a broad geographic region (including Europe, North Africa, the Middle East, central Asia and the Americas), the book provides a valuable foundation for understanding the Earth's seismic past and potential future seismic hazard.

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Frontmatter

[More information](#)

Contents

Preface page ix

Part I Defining historical seismology

- 1 **What is historical seismology?** 3
 - 1.1 The interest in historical earthquakes and tsunamis 3
 - 1.2 The historical approach to seismology 6
 - 1.3 Some key ideas in historical seismology 8
- 2 **The importance of historical earthquake and tsunami data** 11
 - 2.1 The scientific understanding of earthquakes and tsunamis 11
 - 2.2 Earthquake catalogues and their history 26

Part II Issues concerning the interpretation of historical earthquakes and tsunami data

- 3 **Written historical sources and their use** 39
 - 3.1 A definition of historical sources 39
 - 3.2 Types of written historical sources 41
- 4 **Types of scientific sources: historical interpretations of earthquakes (an *excursus* from the ancient world up to the twentieth century)** 147
 - 4.1 Theories and treatises of the past 147
 - 4.2 Scientific studies and services 186
- 5 **Other types of sources** 195
 - 5.1 Historical earthquake cartography 195
 - 5.2 Iconographic sources (drawings, frescoes, etc.) 204

Cambridge University Press

978-0-521-83795-8 - Earthquakes and Tsunamis in the Past: A Guide to Techniques in Historical Seismology

Emanuela Guidoboni and John E. Ebel

Frontmatter

[More information](#)

vi Contents

- 5.3 Sources written with light 206
- 5.4 Unwritten sources 217
- 6 Potential problems in historical records 221**
 - 6.1 Problems inherent in the historical sources 221
 - 6.2 Problems inherent in the use of historical sources 228
 - 6.3 False and lost earthquakes 247
- 7 Determination of historical earthquakes: dates and times 263**
 - 7.1 The need for a common time base for earthquake catalogues 263
 - 7.2 Dating styles and practice in ancient Mediterranean cultures 265
 - 7.3 Years, months and days 265
 - 7.4 The measurement of the hours from the ancient world to the modern era 284
 - 7.5 Earthquake duration 294
- Part III Practical guidelines for the analysis of historical earthquake data**
- 8 Planning the goals of analysis of historical earthquake data 299**
 - 8.1 Reviewing existing earthquake and tsunami catalogues 299
 - 8.2 The search for fresh historical data 302
 - 8.3 Different research strategies for large and small earthquakes 304
 - 8.4 Seismic crises, sequences and multiple earthquakes: picking them out from among the sources 314
 - 8.5 Foreshocks and aftershocks: why targeted research is useful 320
 - 8.6 Epicentres at sea or on land? 322
 - 8.7 The completeness of an earthquake catalogue: some general considerations from the historical point of view 325
- 9 Processing historical records 329**
 - 9.1 The validation of historical data 329
 - 9.2 Classifying a list of references 332
- 10 From interpretation of historical records to historical seismic scenarios 336**
 - 10.1 Constructing seismic scenarios: a painstaking montage of different elements 336
 - 10.2 Terminology and modes of expression 337
 - 10.3 Place-names, administrative boundaries, frontiers and their changes 341
 - 10.4 Territorial factors in seismic scenarios 345
 - 10.5 Human impact 352

Cambridge University Press

978-0-521-83795-8 - Earthquakes and Tsunamis in the Past: A Guide to Techniques in Historical Seismology

Emanuela Guidoboni and John E. Ebel

Frontmatter

[More information](#)

Contents vii

- 10.6 The effects of earthquakes on construction practices 366
- 10.7 Effects in towns: constructing an urban seismic scenario of the past 378
- 10.8 Effects on the natural environment 380
- 10.9 Identifying faulting and liquefaction features in historical accounts 394
- 10.10 Tsunamis: loss of data and descriptive uniformity 401
- 10.11 Earthquake effects on a regional scale: outlining a complex seismic scenario 413
- 11 Traces of earthquakes in archaeological sites and in monuments 418**
 - 11.1 Historical seismology and archaeology 418
 - 11.2 Traces of earthquakes in historical construction and monuments 437
- 12 Deriving earthquake source and shaking parameters and tsunami parameters from historical data 473**
 - 12.1 On the dates and times of earthquakes and tsunamis from historical records 475
 - 12.2 Macroseismic intensity and historical reports 480
 - 12.3 Comparing historical and modern earthquakes to estimate earthquake location, size and strength of ground-shaking 488
 - 12.4 Estimating tsunami parameters from historical data 504
- 13 Cooperation in historical seismology research 514**
 - 13.1 The accuracy of historical earthquake and tsunami data 515
 - 13.2 Improving earthquake catalogues 517
 - 13.3 Improving seismic hazard estimations 520
 - 13.4 Bringing seismologists, historians and archaeologists together 521
- Glossary* 523
- Bibliographical summaries* 531
- References* 537
- Index* 584

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[More information](#)

Preface

In one sense, the person most responsible for this book is our colleague Jelle De Boer, Professor of Geology at Wesleyan University in Middletown, Connecticut. In October 2000 Emanuela Guidoboni made a trip to the United States and one of her stops was to visit Jelle at Wesleyan. Being a good host, Jelle wanted to introduce Emanuela to others in the New England region who were interested in historical seismology (at Yale University and Boston College). In the past, Jelle had worked with John Ebel at Boston College on the past earthquake activity at Moodus, Connecticut, and he was very familiar with John's work on the historical earthquake activity in northeastern North America. Thus, he arranged with John to have Emanuela visit Boston College and give a talk on her work in historical seismology. It was from this meeting that the collaboration of a historian of seismicity from Bologna, Italy, and a seismologist from Boston, Massachusetts began.

The idea for this book came from the mutual awareness that although in many countries of the world historical research into important earthquakes of the past has been performed and is still in progress, there was no handbook on how actually to carry out historical seismology research, with successful strategies and results highlighted and problems, pitfalls and mistakes specified. Such a guide could be a handy reference for professional researchers in many different countries, while students and amateur investigators who were interested in dealing with data on past seismicity could learn from such a text. A similar idea, but on a more limited scale, had been the topic of some work that Emanuela had conducted years before at the request of the International Atomic Energy Authority (particularly, Aybars Gürpınar), on behalf of whom she had studied the strong earthquakes of Armenia. Some sketchy 'guidelines' concerning how to carry out research in historical seismology were first drafted in Vienna in December 1994 by Emanuela and some colleagues (for the seismological part, by Agn s Levret and Claudio Margottini). Although some pages had already been written, for a

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Frontmatter

[More information](#)

x Preface

number of years this early effort remained an idea to be expanded upon and brought to fruition. In the meantime, the methodological approach to historical seismology had become much better defined and accepted thanks to the research experiences of a number of investigators. Historical seismology was indeed emerging as a neo-discipline of its own.

Following her visit to Boston College, Emanuela approached John to work with her on her dormant idea of a handbook on historical seismology. John accepted her invitation to play an active role in this project. Because of their importance in the Mediterranean world, we decided to include historical tsunamis along with historical earthquakes as major topics in the book, and we defined historical seismology broadly enough to include archaeoseismology and the seismic effects on monuments. To keep the book at a manageable size and to maintain coherence in the presentation, we decided to omit some topics that are somewhat more peripheral to historical seismology. For example, historical volcanic eruptions and historical earthquakes associated with active volcanoes are important research topics that we have decided not to include directly in our presentation. Even so, many of the ideas that we present concerning research into historical earthquakes and tsunamis are quite pertinent for research into the historical traces of other natural hazard phenomena. Once we had converged on a scope and outline for our book, we convinced Cambridge University Press to be our publisher and set to work on the writing.

From the outset, it was our goal to write a book that would be a useful reference both to those seismologists and earthquake engineers who carry out research into historical earthquakes and to historians and archaeologists who want or need to know about past earthquakes and their consequences for the affected populations and their buildings. Hence we wrote the book as a kind of tutorial with these widely diverse audiences in mind. We have chosen to include many examples, both in pictures and in words, of the many details and subtleties that make accurate historical seismology research and the proper interpretation of seismological parameters from historical seismological sources such a challenge.

While efforts to compile information on historical earthquakes have been undertaken for several hundred years, in many ways historical seismology is still a comparatively young research discipline. It has only been in recent times that historians have brought to bear their full and significant interpretive tools on those historical sources that describe the earthquakes and tsunamis of the distant past. And for those seismologists who have been studying historical seismicity with an eye toward better defining the seismic hazard of different parts of the world, new analytical tools that give a modern understanding to past historical earthquakes have only been developed over the last decade or so. It

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[More information](#)

is our sincere hope that this book will stimulate new research into historical earthquakes and will lead to the development of new seismological methods for interpreting the data that accrue from that new research.

Both of us owe our thanks to many people for their assistance in the production of this book: Alberto Comastri, for his assiduous, competent and invaluable support, Maria Giovanna Bianchi and Gabriele Tarabusi of SGA, for their help in preparing the figures and maps. Thanks also to Jean-Paul Poirier and Gianluca Valensise for their corrections and suggestions, and to Enzo Boschi, President of the Istituto Nazionale di Geofisica e Vulcanologia, who has supported the historical research into earthquakes in Italy with great foresight, and for his encouragement in writing this book. Dina Smith at Weston Observatory of Boston College provided a thorough proofreading of the book. Susan Francis at Cambridge University Press was of great help to us, and was extremely patient and encouraging when we were tardy meeting our deadlines. Finally, John wishes to thank his wife Martha, whose constant love and support during many evenings and weekends of writing and revising gave him the strength to carry on. Emanuela is grateful to her three wonderful grandchildren, Emmanuel, Luis and Lorenzo, who with their voices and games provided a pleasant background to this book over many a weekend.

The authors apologize for often having resorted to case studies they had themselves analysed or studies pertaining to research they themselves or their work group had performed, which have provided most of the discussion material.

The authors devised and discussed all of the chapters together and jointly reviewed them, commented upon them and at times added to them. However, as a result of their different scientific backgrounds, the drafting of the chapters was subdivided as follows:

Chapters 1, 2: Emanuela Guidoboni and John E. Ebel

Chapters 3, 5, 6, 7, 8, 9, 10 and 11: Emanuela Guidoboni

Chapters 12 and 13: John E. Ebel

Chapter 4: in Section 4.1 Emanuela wrote the part on the ancient world up to the eighteenth century, John the subsequent part; Emanuela wrote Section 4.2.