

Earthquakes and Tsunamis in the Past

A Guide to Techniques
in Historical Seismology

EMANUELA GUIDOBONI

Istituto Nazionale di Geofisica e Vulcanologia, Bologna

JOHN E. EBEL

Boston College, Massachusetts

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

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

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
	<i>Glossary</i>	523
	<i>Bibliographical summaries</i>	531
	<i>References</i>	537
	<i>Index</i>	584