

Contents

PREFACE	VII
-------------------	-----

Part I. Global Tectonics

CHAPTER 1. CONTINUITY AND CHANGE	3
Synopsis	3
Evidence of change	4
Geologic continuity	7
CHAPTER 2. GEOLOGIC HISTORY	11
History of Pangaea	11
Geochronology	11
Dating of rocks in the field	13
Tectonic revolutions	15
The breakup of Pangaea	16
CHAPTER 3. EARTHQUAKES	21
Introduction	21
Earthquake parameters	24
Seismic waves	28
Mechanism at the source	29
Elasticity and anelasticity	34
Equivalent viscosity of the mantle	38
Aftershocks	39
Earthquakes and explosions	41
CHAPTER 4. PLATE TECTONICS	45
Introduction	45
The plate concept	45
Geometry of sea-floor spreading	48
Tectonics of sea-floor spreading	49
Stresses in lithospheric plates	51
Transcursion in California	53
Viscoelastic rebound as an earthquake mechanism	55
Subduction	58
Accretion	60
The Elsassser model	61
The South American West Coast	64

Part II. Earthquake Risk

CHAPTER 5. STOCHASTIC PROCESSES	73
Introduction	73
Statistics	74

Bayesian statistics	75
Independence	76
Stationarity	77
Homogeneity	77
 CHAPTER 6. POINT PROCESSES	 79
Definition	79
The Poisson process	79
Markov processes	81
Renewal processes	82
Generalized Poisson processes; superposition	82
 CHAPTER 7. MODELLING THE EARTHQUAKE PROCESS	 85
Introduction	85
A heuristic model for the earthquake process	87
The Klondike model in earthquake theory	88
The Kolmogorov process	91
Boltzmann processes	95
The tagged self-exciting process	97
A topological model	99
 CHAPTER 8. EXTREME-VALUE METHODS	 101
Introduction	101
Earthquake maxima	101
An application to California	104
The maximum magnitude in a region	106
 CHAPTER 9. EARTHQUAKE ZONING	 111
Why seismic zoning?	111
Soviet concepts of zoning	111
Earthquake zoning in the U.S.A.	112
Risk mapping	114
Approaches to earthquake prediction	116
 CHAPTER 10. ESTIMATION PROCEDURES FOR EARTHQUAKE RISK	 119
Introduction	119
Approaches of analysis	119
Extreme-value methods	121
Bayesian methods	122
Optimization methods	122
Composition methods	123
Zoning methods	125
Simulation methods	125
A case history	127
Project description	127
Geologic situation	129
Seismotectonic setting	129
Seismic history	130
Estimation of earthquake risk	130
“Pessimistic” earthquake risk	131
“Poissonian” risk	133
Incorporation of historical data	133
Summary of risk estimates	134

CHAPTER 11. STRATEGIES FOR CONTROL OF EARTHQUAKE HAZARD	137
Introduction	137
Initial strategies	137
Alternative strategies	140
Prediction versus prevention?	141
An earthquake strategy	141

Part III. World Seismicity

CHAPTER 12. THE DATA	147
Seismographs	147
Strain meters	147
Accelerometers	148
Velocity and displacement seismographs	149
Exploration seismographs	150
Earthquake data processing	150
Array technology	153
CHAPTER 13. SEISMIC REGIONS OF THE WORLD	157
Introduction	157
Regional distribution	158
Seismicity maps	158
CHAPTER 14. CIRCUM-PACIFIC BELT	175
Introduction	175
North America	175
Alaska	177
Alaskan panhandle to Washington State	181
California, Nevada and Oregon, and Baja California	184
Eastern and central North America	188
Central and insular America	190
Mexico to Guatemala	190
Central America	195
Caribbean Arc and Venezuela	198
South America	200
Extension and seismicity	200
Northern Andes	200
Central Andes	207
Southern Andes	207
Patagonia	209
Scotia Arc	210
South Pacific Ocean	211
New Zealand	211
Tonga, Kermadec, Fiji, and Samoa	213
New Hebrides and Santa Cruz Islands	216
Solomon and Bismarck Archipelagoes	217
New Guinea	219
Western Pacific Ocean	219
Micronesia	220
Northern Japan, Kurile Islands, and Kamchatka	222

CHAPTER 15. EAST ASIAN INSULAR BELT AND EURASIA	227
Introduction	227
East Asian insular belt	228
Kyushu and Ryukyu Islands	228
Taiwan	230
Philippines	231
Molucca Sea	233
Banda and Sunda Arcs	235
Eurasian domain	243
China	245
Pamir–Balkhash region	248
Mongolia–Baikal–Sinkiang area	249
Burma	250
Himalaya	251
Pakistan and West India	252
Iran–Caspian Sea	257
Asia Minor–Balkans	260
Western Europe and North Africa	265
Seismicity and seismic geography	265
 CHAPTER 16. SOUTHERN CONTINENTAL SHIELDS	271
Introduction	271
Africa and Arabia	271
Seismicity and seismic geography	271
Australia	272
Antarctica	272
 CHAPTER 17. OCEANIC RISES	277
Introduction	277
Mid-Atlantic and Arctic Ridge	277
Indian Ocean	278
East–Central Pacific Rise and Hawaiian Islands	287
 APPENDIX 1. Earthquake Regulations (Section 2314) of the 1968 Los Angeles County Building Code	
Sec. 2314 – Earthquake regulations	291
 REFERENCES	303
 INDEX	309